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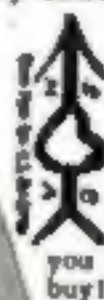
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(right
off!)

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Arrow on
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WELL,—WHY SHOULD A GARAGE BE HOMELY?

SEE
CUT
BELOW

This one isn't—(Is it?) The man just driving out (in the picture below) is the owner. He looks well satisfied with the fact that he has enhanced the beauty of his grounds at the same time that he has protected his car.

The picture shows how *your* garage may look if you will allow us to send you, with our compliments, and with no obligation at all, the

Complete Working Drawings (on sheet 24 x 36 inches)

including full specifications—enough for any good carpenter to build from. Perhaps you enjoy such work yourself. If so, you can't go wrong.

It might even be possible to remodel your present garage on these lines. If you do so, of course you will know what kind of lumber to buy. "If you build of Cypress you build but once." You know "The Wood Eternal" is the champion pergola lumber—does not tend to shrink, swell or warp like so many woods—takes paint and stain beautifully, but *does not need* either, except for looks—lasts and lasts and lasts and lasts without them. (See U. S. Govt. Rept., reprinted in full in Vol. 1, Cypress Pocket Library. Just mention that you'd like that book, also—Vol. I.)

The Cypress "Pergola-Garage"

This Pergola-Garage is
AN ADDED SUPPLEMENT
to the 9th big reprint of
VOLUME 28 of that home-
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Popular Science Monthly

MAY, 1920
Volume 96-No. 5

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225 West Thirty-ninth St. New York City

Why My Memory Rarely Fails Me

and how the secret of a good memory may be learned in a single evening

By DAVID M. ROTH

NOTE: When I asked Mr. Roth to tell in his own words, for nation-wide publication, the remarkable story of the development of his system for the cure of bad memories, I found him reluctant to talk about himself in cold print. When I reminded him that he could do no finer service than to share his story with others—just as he is sharing his method for obtaining a better memory with thousands who are studying his famous Memory Course—he cordially agreed to my proposal. And here is his story.—President Independent Corporation.



DAVID M. ROTH

FIFTY members of the Rotary Club were seated in the banquet hall of the Hotel McAlpin in New York. I was introduced to each member in turn, and each gave me his telephone number and told me his occupation. An hour later, after they had changed seats while my back was turned to them, I called each man by name, gave his telephone number and named his occupation, without a single error.

The following evening, in the office of a large business institution, I asked the president of the concern to write down fifty words, numbers and names, and to number each item. An hour later I called out each item, and gave the number opposite which it had been written.

At another time I glanced at the license numbers of a hundred and five automobiles which passed. These numbers were written down by witnesses, in the order in which the cars passed. Later I called each number correctly and gave the order in which the numbers went by.

From Seattle to New York I have appeared before salesman's meetings, conventions, and Rotary Clubs giving demonstrations of my memory. I have met over 10,000 people in my travels. Yet I am quite sure I can call nearly every one of these men and women by name the instant I meet them, ask most of them how the lumber business is or the shoe business or whatever business they were in when I was first introduced to them.

People wonder at these memory feats. Hundreds have asked me how I can store so many facts, figures, and faces in my mind, and recall them at will. And they are even more mystified when I explain that my memory used to be so poor I would forget a man's name twenty seconds after I met him! In fact that was what led me to investigate and study the cause of poor memory and the remedy. For years I had read books on psychology, mental culture, memory, and other subjects. All of these books were good, but none of them was definite or easy enough. So I labored until I found out what it was that enabled me to remember some things while I forgot others. Finally I worked out a system that made my memory practically infallible.

I explained my system to a number of friends and they could hardly believe it possible. But some of them tried my method and invariably they told me they had doubled their memory power in a week. They got the method the first evening and then developed it as far as they cared to go.

The principles which I had formulated in improving my own memory were so simple and so easy to apply that I decided to give my method to the world.

At first I taught my memory system in person. My classes, in Rotary Clubs, banks, department stores, railway offices, manufacturing plants and every kind of business institution grew amazingly in size and number. Memory teaching became my sole profession, and a wonderful experience it has been all the way from Seattle to New York City.

I soon realized that I could never hope to serve more than a small fraction of those who needed my memory system and were eager to take it up unless I put it into a home-study

course which people could acquire without personal instruction.

The Independent Corporation, whose President, Mr. Karl V. S. Howard, had become interested in my work as a member of my Rotary Club class in New York, saw the large possibilities of my Course as an element in their broad program for personal efficiency and self-improvement.

So it was my pleasure to join forces with this great publishing house, and the Roth Memory Course, in seven simple lessons, was offered to the public at a price of \$5 (correspondence courses having been sold hitherto at anywhere from \$20 to \$100).

No money in advance was to be asked, the idea being that the Course must sell itself purely on its merits.

As you have doubtless observed, an extensive advertising campaign was launched by my publishers with full page announcements in all the leading periodicals of the country and in many leading newspapers.

This campaign has continued without a let-up and with ever growing momentum.

From the very start this advertising became successful. The idea spread. Orders came in from everywhere. Edition after edition of the lessons was printed and still thousands of orders could not be filled.

The promise was made that the Course would improve any man's or woman's memory in one evening. And it did! Letters of praise began to pour in almost as fast as the lessons were shipped—and have kept up ever since in a veritable flood.

For example, Major E. B. Craft, Assistant Chief Engineer of the Western Electric Company, New York, wrote:

"Last evening was the first opportunity I had to study the course, and in one sitting I succeeded in learning the list of 100 words forward and backward, and to say that I am delighted with the method is putting it very mildly. I feel already that I am more than repaid in the real value and enjoyment that I have got out of the first lesson."

Read this letter from Clarence J. McManus, of the firm of Okott, Bonyage, McManus & Ernst, Attorneys and Counsellors at Law, 170 Broadway, and one of the most famous trial lawyers in New York:

"May I take occasion to state that I regard your service in giving this system to the world as a public benefaction. The wonderful simplicity of the method, and the ease with which its principles may be acquired, especially appeal to me. I may add that I already had occasion to test the effectiveness of the first two lessons in the preparation for trial of an important action in which I am about to engage."

McManus didn't put it a bit too strong. And here is just a quotation from H. O. (Multi-graph) Smith, Division Manager of the Multi-graph Sales Co., Ltd., in Montreal:

"Here is the whole thing in a nutshell: Mr. Roth has a most remarkable Memory Course. It is simple and easy as falling off a log. Yet with one hour a day of practice anyone—I don't care who he is—can improve his memory in a week and have a good memory in six months."

Then there is the amazing experience of Victor Jones, who increased his business \$100,000 in six months. And there are hundreds and thousands of others who have studied the Course and who have secured greater benefit from it than they dreamed possible.

Perhaps the main reason why my method is so successful is because it is so ridiculously simple. You get the method of obtaining an infallible Memory in one evening—in the very first lesson. Then you develop your memory to any point you desire through the other six lessons. There are only seven lessons in all. Yet the method is so thorough that your memory becomes your obedient slave forever. And instead of being hard work, it is as fascinating as a game. I have received letters from people who say the whole family gathers round the table for each lesson!

Men and women from coast to coast have thanked me for having made it so easy for them to acquire an infallible memory. As one man said:

"Memory and good judgment go hand in hand. Our judgment is simply the conclusions we draw from our experience, and our experience is only the sum total of what we remember. I now store away in my mind every valuable fact that relates to my business, whether it is something I hear or read, and when the proper time comes I recall all the facts I need. Before I studied the Roth Course it took me three times as long to gain experience simply because I forgot so many facts."

And how true that is! We say of elderly men that their judgment is "ripe." The reason it is ripe is because they have accumulated greater experience. But if we remember all the important facts we can have a ripened judgment 15 or 20 or 30 years sooner!

Thousands of sales have been lost because the salesman forgot some selling point that would have closed the order. Many men when they are called upon to speak fail to put over their message or to make a good impression because they are unable to remember just what they wanted to say.

Many decisions involving thousands of dollars have been made unwisely because the man responsible didn't remember all the facts bearing on the situation, and thus used poor judgment. In fact, there is not a day but that the average business man forgets to do from one to a dozen things that would have increased his profits. There are no greater words in the English language descriptive of business inefficiency than the two little words, "I forgot."

My pupils are gracious enough to say that nothing will make that fatal phrase obsolete so quickly as the memory system it has been my good fortune to evolve.

Mr. Roth had told his story. It now remains for you to turn it into dividends. This will happen, we are sure, if you will spend the fraction of time it requires to send for his complete Course on absolute approval.

After a few hours spent with the Roth Memory Course the fear as well as the tragedy of forgetting should be largely eliminated. You will obtain a fascinating new sense of confidence and power.

Not only that, but you will have a sense of freedom that you never felt before. You will be freed of the memorandum pad, the notebook, and other artificial helps to which most of us are slaves.

So confident is the Independent Corporation, the publishers of the Roth Memory Course, that once you have an opportunity to see in your own home how easy it is to double, yes, triple your memory power in a few short hours, that they are willing to send the course on free examination.

Don't send any money. Merely mail the coupon or write a letter and the complete course will be sent, all charges prepaid, at once. If you are not entirely satisfied send it back any time within five days after you receive it and you will owe nothing.

On the other hand, if you are as pleased as are the thousands of other men and women who have used the course, send only \$5 in full payment. You take no risk and you have everything to gain, so mail the coupon now.

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Dept. R-775, 310 Sixth Ave., New York

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By Frederick Park Lew
- ☐ Super Salesmanship (37)
By Arthur Newcomb
- ☐ Pathology Course in Personal Efficiency
By Edward Earle Peniston
- ☐ Form Home-Account System (38)
By Wesley W. Ferris

Name.....

Address.....

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Training for
Head and
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Yours faithfully,
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City State

Occupation or Business

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How to Increase Your Will Power In One Hour

Author of This Article Tells How He Quickly Acquired a Dominating Will Power That Earns Him Between \$50,000 and \$70,000 a Year

FOUR YEARS ago a man offered me a wonderful bargain. He was hard up for money and wanted to sell me some shares in a young, growing company for \$1,000. Based on the earnings of the Company the stock offered me was easily worth \$5,000—in fact, the man who finally bought the shares sold them again in five months at a profit of \$4,300.

The reason I didn't buy the shares was that I could no more raise a thousand dollars than I could hop, skip, and jump across the Atlantic Ocean. A thousand dollars! And my income only twenty-five a week.

The second chapter in my life began a few months later, when another opportunity came to me. It required an investment of \$20,000 during the first year. I raised the money easily, paid back every penny I borrowed, and had \$30,000 left at the end of the first year! To date in less than four years, my business has paid me a clear profit of over \$200,000 and is now earning between \$50,000 and \$70,000 a year. Yet for twelve years before, the company had been losing money every year!

The natural question for my reader to ask is, "How could you borrow \$20,000 to invest in a business which had previously been a failure, after being unable to borrow \$1,000 for an investment that seemed secure?" It is a fair question. And the answer can be given in two little words—WILL POWER.

When the first proposition came to me I passed it by simply because I didn't have the money and couldn't borrow it. I went from

one friend to the next and all turned me down. Several refused to talk business with me at all. They all liked me personally, and they asked about the kiddies, but when it came to money matters I hadn't a chance. I was scared stiff every time I talked to one of them. I pleaded with them, almost begged them. But everybody had their "moneyallied up in other investments." It was an old excuse, but I accepted it meekly. I called it hard luck. But I know today that it was nothing in the world except my lack of Will Power or rather my weak Will Power, which kept me from getting what I wanted.

When I heard that the man sold them shares at a profit of \$4,300, it seemed that my sorrow could not be greater. That profit was just about what my salary amounted to for four years! But instead of grieving over my "hard luck," I decided to find out why I was so easily beaten in everything I tried to accomplish. It must be that there was something vital that made the difference between success and failure. It wasn't lack of education, for many illiterate men become wealthy. What was this vital spark? What was this one thing which successful men had and which I did not have?

I began to read books about psychology and mental power. But everything I read was too general. There was nothing definite—nothing that told me what to do. After several months of discouraging effort, I finally encountered a book called "Power of Will," by Prof. Frank Channing Haddock. The very title came to me as a shock. When I opened the book I was amazed. I realized that will power was the vital spark—the one thing that I lacked. And here in this book were the very rules, lessons and exercises through which anyone could increase their will power. Eagerly I read page after page, including such articles as The Law of Great Thinking; How to Develop Analytical Power; How to Concentrate Perfectly; How to Guard Against Errors in Thought; How to Develop Fearlessness; How to Acquire a Dominating Personality.

An hour after I opened the book I felt like a new person. My sluggish will power was beginning to awaken. There was a new light in my eye, a new spring in my step, a new determination in my soul. I began to see, in my past, the many mistakes I had made, and I knew I would never make them again.

I practiced some of the simple exercises. They were more fascinating than any game of cards or any sport.

Then came an opportunity to acquire the business which had lost money for twelve years, and which I turned into a \$50,000 a year money maker. Instead of cringing before the moneyed people, I won them over by my sheer force of will. I would not be denied and my every act and word since then has been the result of my training in will power.

I am convinced that every man has within himself every essential quality of success except a strong will. Any man who doubts that statement need only analyze the successful men he knows, and he will find himself their equal, or their superior, in every way except in will power. Without a strong will, education counts for little, money counts for nothing, opportunities are useless.

I earnestly recommend Prof. Haddock's great work, "Power of Will," to those who feel that success is just out of reach—to those who lack that something which they cannot define, yet which holds them down to the grind of a small salary.

Never before have business men and women needed this help so badly as in these trying times. Hundreds of real and imaginary obstacles confront us every day, and only those who are masters of themselves and who hold their heads up will succeed. "Power of Will" as never before is an absolute necessity—an investment in self-culture which no one can afford to deny himself.

I am authorized to say that any reader who

cares to examine "Power of Will" for five days may do so without sending any money in advance. If after one hour you do not feel that your will power has increased, and if after a week's reading you do not feel that this great book supplies that one faculty you need most to win success, return it and you will owe nothing. Otherwise send only \$3.50, the small sum asked.

Some few doubters will scoff at the idea of will power being the fountain head of wealth, position and everything we are striving for, but the great mass of intelligent men and women will at least investigate for themselves by sending for the book at the publisher's risk. I am sure that any book that has done for me—and for thousands of others—what "Power of Will" has done—is well worth investigating. It is interesting to note that among the 400,000 owners of "Power of Will" are such prominent men as Supreme Court Justice Parker; Wu Ting-fang, Ex-U. S. Chinese Ambassador; Gov. McKeivie, of Nebraska; Assistant Postmaster-General Britt; General Manager Christeson, of Wells-Fargo Express Co.; E. St. Elmo Lewis; Senator Arthur Capper of Kansas; E. T. Meredith, Secretary of Agriculture, and thousands of others. In fact, today "Power of Will" is just as important, and as necessary to a man's or woman's equipment for success, as a dictionary. To try to succeed without Power of Will is like trying to do business without a telephone.

As your first step in will training, I suggest immediate action in this matter before you. It is not even necessary to write a letter. Use the form below, if you prefer, addressing it to the Pelton Publishing Company, 14-J Wilcox Block, Meriden, Conn., and the book will come by return mail. You hold in your hand, this very minute, the beginning of a new era in your life. Over a million dollars has been paid for "Power of Will" by people who sent for it on free examination. Can you, in justice to yourself hesitate about sending in the coupon? Can you doubt, blindly, when you see, without a penny deposit, this wonderful book that will increase your will power in one hour.

The cost of paper, printing and binding has almost doubled during the past three years, in spite of which "Power of Will" has not been increased in price. The publisher feels that so great a work should be kept as low-priced as possible, but in view of the enormous increase in the cost of every manufacturing item, the present edition will be the last sold at the present price. The next edition will cost more. I urge you to send in the coupon now.

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The Law of Great Thinking.
The Four Factors on which it depends.
How to develop analytical power.
How to think "all around" any subject.
How to throw the mind into deliberate, controlled, productive thinking.
Detailed directions for Perfect Mind Concentration.
How to acquire the power of Concentrative Thinking, Reasoning, Analysis.
How to acquire the skill of Creative Writing.
How to guard against errors in Thought.
How to drive from the Mind all unwelcome thoughts.
How to follow any line of thought with keen, concentrated Powers.
How to Develop Reasoning Power.
How to handle the mind in Creative Thinking.
The secret of Building Mind Power.
How the Will is made to act.
How to set your Will.
How a strong Will is Master of Body.
What creates Human Power.
The Six Principles of Will Training.
Definite Methods for developing Will.
The NINETY-NINE METHODS for using Will Power in the Conduct of Life.
Seven Principles of Will in Mental, Physical, Personal Power.
FIFTY-ONE MAXIMS for Applied Power of Perception, Memory, Imagination, Self-Analysis, Control.
How to develop a strong, keen gaze.
How to concentrate the eye upon what is before you—object, person, printed page, work.
These are only a few of the many subjects treated.

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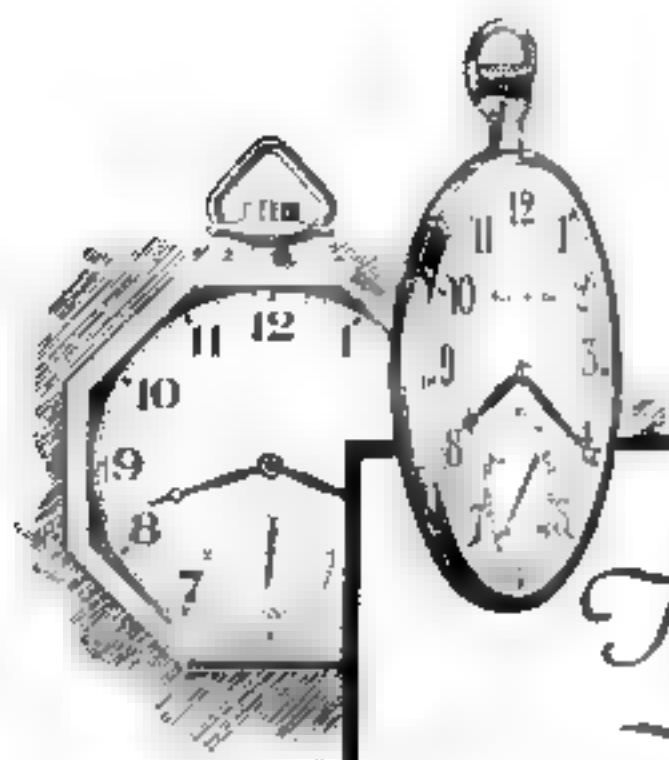
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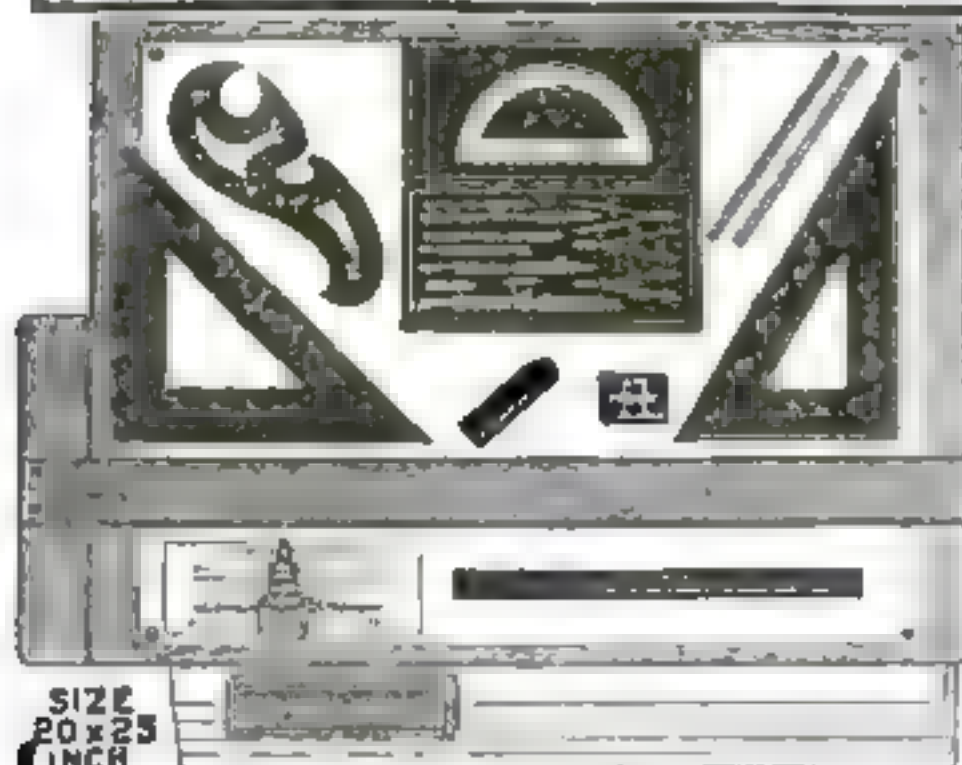
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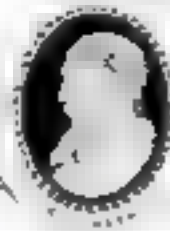
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Look Out for a Crash When the Crowd Gets Up

By Alfred J. Lotka

FIVE thousand tons of human flesh and blood! Such is the audience in the Yale Bowl when it is filled to the limit. Perhaps you have never thought of a crowd in these terms. But the engineer who designs a grand stand, for example, has to consider not only the dead weight of the crowd that will sit on it, but the possibility of other forces that the crowd may develop.

Yale students, in their "rush," form aides and line up in two groups ten men abreast and thirty deep. The men stand in close formation, with their arms locked before them. These two masses face each other, and at a signal slowly move forward. The force thus developed is amazing. Not infrequently ribs are broken by the slow pressure, and heavy men are lifted bodily above the heads of the crowd.

Similar conditions must arise, for example, in a theater in case of an alarm of fire, when people press against one another in their rush for the doors. A simple calculation shows the intensity of the pressure that may thus be developed. The push or pull that a man can exert horizontally, when standing on a horizontal floor surface, depends on the coefficient of friction of the soles of his feet against the floor. As an approximate and conservative value of this coefficient we may take the figure .2, or one fifth. This means that a man can push or pull horizontally, on a

level floor, with a force of about one fifth of his weight, say about 30 pounds.

If all the members of a crowd twenty rows deep are pushing toward a narrow door and against the walls on each side of it, persons standing against the wall may have to bear a crushing pressure of something like 600 pounds each.

In designing structures that are liable to be subjected to stresses from crowds, engineers commonly figure on a dead load of about 100 pounds a square foot.

But this assumes the crowd to be sitting or standing still. The situation may be very different if the crowd is

moving. If the motion is irregular the matter may not be very serious. But watch the fans at a football or baseball game. A brilliant tackle or a spectacular catch, and the whole crowd rises to their feet as one man. The effect of such concerted action may be serious.

A systematic investigation of some of the stresses produced by movements of live loads was carried out some time ago by Professor C. J. Tilden of Johns Hopkins University; the results were published in the *Proceedings of the American Society of Civil Engineers*.

Professor Tilden placed a man on the platform of a scale, and moved the counterpoise until it registered some 40 or 50 pounds in excess of his weight. The subject of the experiment was asked to crouch down and then suddenly to rise.

This was repeated a number of times, with the counterpoise each time in a different position, until the highest point was found at which the



Professor Tilden found that the act of standing up from a crouching position on a platform added over 60 per cent to the man's weight.



The forces developed in a rush are amazing. Ribs are broken by the slow pressure, and heavy men are lifted bodily above the heads of the crowd.



When the crowd gets up and stretches before the seventh inning, or when it rises to its feet and yells when the touchdown is made at the football game, what is the effect on the grand stand? Professor Tilden, of Johns Hopkins University, who

recently conducted a systematic investigation along this line, shows that a man, in rising suddenly from his seat, may exert a horizontal force of about one half his weight. We wonder if grand stand designers take this into consideration

counterpoise was just lifted by the effect of the man's movement. It was found that the act of standing up from a crouching position added 87 per cent to the man's weight. Getting up from a chair added 79 per cent. A sudden straightening out of the body after standing with slightly bent knees, and a simultaneous throwing down of the arms, so as to obtain a maximum effect, added no less than 174 per cent to the dead weight.

Professor Tilden also investigated the horizontal thrust, which may be produced, for example, by a man getting up from a chair. He estimated that the ratio of the movements of the center of gravity in horizontal and in vertical direction corresponds approximately to the ratio of the intensities of the respective forces. His conclusion is that a man, in rising suddenly from his seat, may exert a horizontal force of about one half his weight, say about 70 pounds.

His method of determining the center of gravity of a man in different positions is interesting. The man is supported at two points, of which one rests on the platform of one scale, the other on that of a second scale. A

vertical line through the center of gravity (centroidal line) then divides the straight line joining the two points of support, in inverse ratio to the weights indicated by the two scales.

By taking two such observations in different positions, the center of gravity is located as the intersection of two centroidal lines. For the erect position one centroidal line can be assumed, without special experiment, to go straight down the vertical axis of the body. Only one more determination is needed in this case, with the man lying across the two scales.

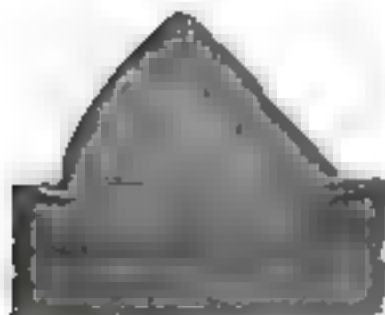
Suppose a number of people are watching a boat race from a bridge. They view the shells approaching from one side, and as the crews pass under the bridge the spectators rush across to see the finish on the other side. What effect will this have on the structure?

If a man weighing 160 pounds, running across the bridge, gets up his maximum speed of 12 feet a second in a distance of 2 or 3 feet, he exerts upon the bridge a horizontal force of 150 pounds, or in other words practically his own weight. If he is brought to an abrupt halt at the end of his run by striking against the side of the

bridge, the impact may put a lateral pressure of several hundred pounds upon the wall or railing. Effects of this kind might exceed the allowance ordinarily made for wind pressure.

What is the horizontal force exerted by a man walking? An analysis of a series of instantaneous photographs of a pedestrian shows that in walking the velocity is not uniform, but fluctuates. It is highest just before the forward foot is set down, and lowest just as the foot in the rear is lifted off the ground. As the velocity changes there must be corresponding changes in acceleration, and hence in the force exerted.

Professor Tilden has computed that the maximum horizontal force that a man weighing 160 pounds exerts against the ground in walking may rise to about 80 or 90 pounds. One would almost expect that slipping would occur before such a force as this were reached. But it must be borne in mind that the pressure of the foot in contact with the ground will for a moment exceed the man's weight—just as the man, suddenly rising from a crouching position on the balance scale, will momentarily register more than his actual weight.



Drop a cork in fresh water, and very little of it will sink below the surface—to be exact, just twenty-four per cent of it will go under. Cork is very buoyant—much more so than Saturn, for instance.



You may not think so, but a human being, breathing properly, can walk into fresh water up to his nose and then find himself floating. He is not so buoyant as Saturn, but at least eleven per cent of him will bob above water. If you have not yet learned how to float on your back, bear this in mind: only eleven per cent of your body will remain above water. If you try to keep your whole head above water you will find it won't work. Just your eyes, nose, mouth, and chin should emerge.

But Saturn has the honor of being more buoyant than any of its fellow planets. It is the only one that would float if they were all thrown into a great body of water. Twenty-eight per cent of it would stay above water. Saturn's lightness as compared with its great size led astronomers to believe that it is not solid but merely a vast envelope of clouds surrounding a heated interior. Saturn's rings, too, are cloud-like, and so thin that they disappear when seen edgewise.

Saturn—It Will Not Sink

SHOULD our eight planets suddenly be dropped into a great body of water, all except Saturn would sink like stones. Saturn, on the contrary, would float gracefully on the surface—rings and all—like a cake of much advertised soap.

That is because Saturn possesses only about three quarters of the density of water. The other seven—Mercury, Venus, Earth, Mars, Jupiter, Uranus, and Neptune—are all denser than water. Our earth leads them all, being about five times as dense. Mercury, Venus, and Mars follow close behind. But the larger, distant planets are far less dense than the

nearer, smaller ones. Jupiter is only about as dense as the sun, and Uranus and Neptune have but one fifth of our earth's solidity.

Were our earth suddenly to possess the consistency of Saturn, and were we to retain our present densities, we would promptly sink in and disappear beneath the surface—that is, if the earth were in a fluid condition. If it still remained solid we would not sink beneath the surface, but would feel as if we were walking on something having the density of cherry wood.

Saturn is very beautiful. When seen through the telescope it has a yellowish color and its three strange

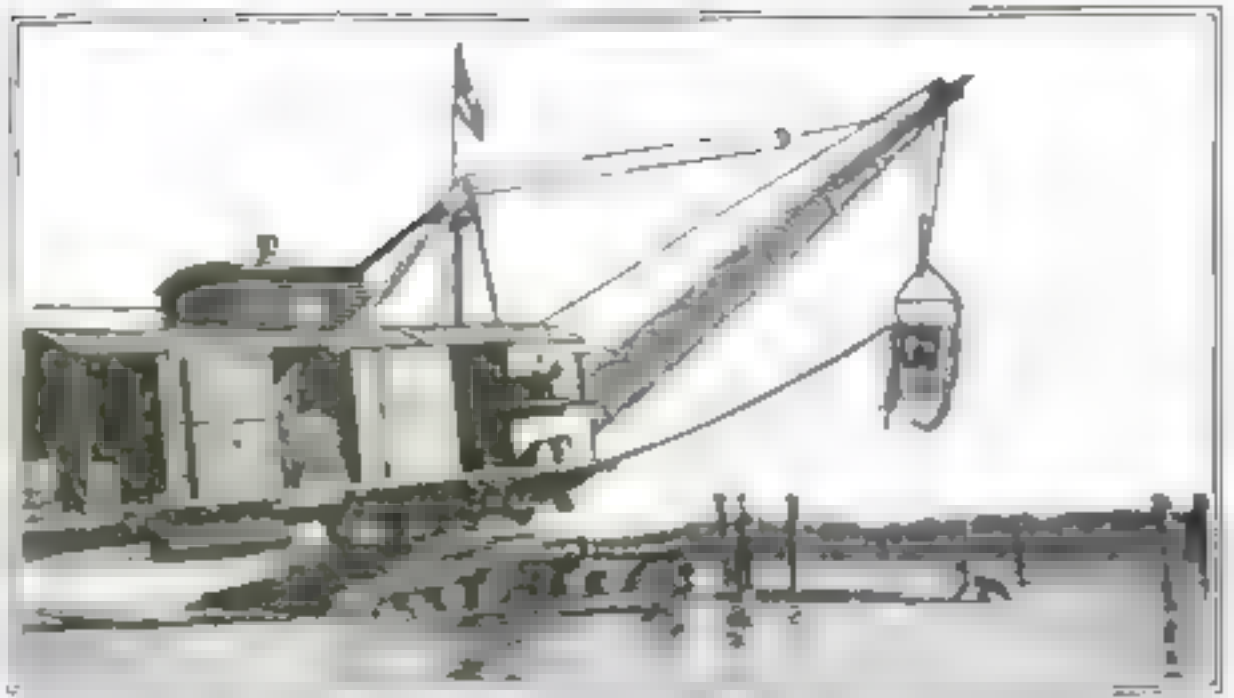
rings are quite visible. It is seven hundred and sixty times as large as the earth in volume, and it travels very slowly around the sun. The earth's speed is eighteen and one half miles a second, whereas Saturn makes only six miles a second. That is one reason why it takes Saturn so long to revolve around the sun. Instead of doing it in a year, as we do, Saturn makes a revolution in thirty years.

In the course of each revolution Saturn's rings appear and disappear from time to time. They are very thin, and when they are in the same plane with our line of vision we cannot see them at all.

An Excavator that Walked Across a Stream

WHEN it became necessary to cross the 800-foot span of the Rio Grande river, a huge 75-ton excavator took the ford and crawled with its caterpillar tractor straight across the swiftly flowing stream. Quicksand lurked in the treacherous bottom, and at any moment the great machine might have been engulfed, had not the engineers carefully considered this problem. They built an arrangement of timbers, guyed and made fast at the points of crossing the channel, and along this temporary track the caterpillar crawled.

The hazardous trip was made from the west side of the Rio Grande at a place called Mesquite. Because of the demands for irrigation water it was impossible to reduce the flow of the river. The heavy caterpillar tractor crawled across the river in six hours and thirty minutes.



Fording the Rio Grande with a 75-ton excavator! The feat was accomplished by arranging timbers to form a kind of flexible track securely fastened on each side of the channel.

A Checkerboard of Artificial Daylight for Workers in Color

CAN you distinguish tints of green and blue when you see them by artificial light furnished by the ordinary electric bulb?

These colors may be distinguished from each other, but their various intensities fall by the wayside and are lost in artificial illumination, unless special provision is made to save them. The green that you saw in the diffused daylight may have been twice as intense as the green shown by the electric bulb, while the blue in daylight may have been nine times more intense than the blue of the incandescent lamp. The true color of a diamond can not be judged by the ordinary artificial light, nor can that of tobacco.

Think of the valuable working hours wasted by the waning of the daylight in industries where true color must be judged!

An English artist, Mr. George Sheringham, has experimented with a method of his own invention calculated to correct this defect. A checkerboard arrangement of squares of blue, purple, and green, placed in a concave reflector above the light, sends downward a blended reflection of rays approaching daylight in quality.

Of course the colors of the squares must



This arrangement reflects the light waves, selecting those that compose daylight and throwing them downward in blended artificial daylight.

be such that they reflect the right light sensations, the daylight hidden in the artificial source of illumination. The yellow and red rays that tinted the white light are proportionately absorbed and stopped by the colored squares, and it is claimed that by this simple method of illumination an exact reproduction of the quality of daylight can be attained.

The diamond merchant, the color-printer, wall-paper manufacturers, dye-works craftsmen, and those of the textile trade, will be among the chief beneficiaries of this remarkable invention. Artists can paint in color at night, and this is what inspired the artist-inventor to experiment with the method.

The painter who is inspired by the symphony concert will not have to wait until morning to dab on canvas the color sensations which the musical mood may have inspired. If he answered the call of the inspirational moment as soon as he reached his studio, home from the concert, the daylight view next day of the sketch painted by ordinary artificial light would be quite different from his night-time intentions. With an artificial daylight a valuable color idea could be saved.

What to Do with "Electrocuted" Gas-Pipes



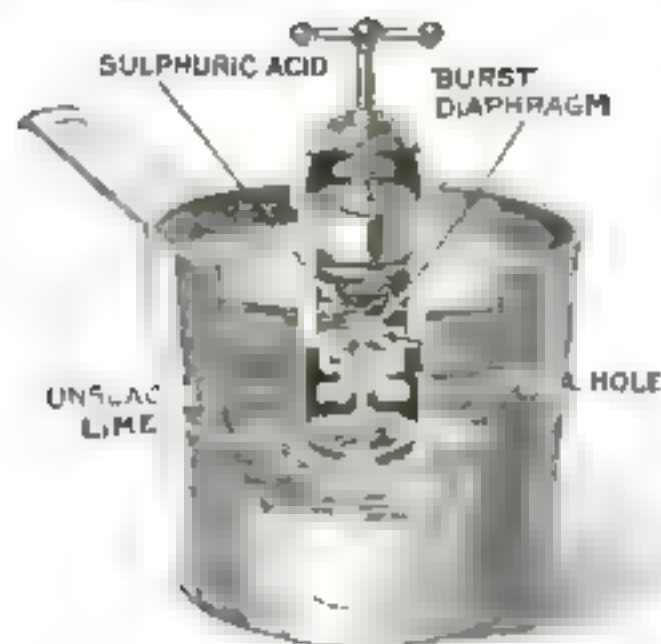
Gas-pipes "electrocuted" by stray currents from electric railways, their life as pipes being ended.

DOES the gas-pipe or the water-pipe leak? An examination of these pipes may disclose an astonishing condition. From five to ten years after new pipes are installed, one may be annoyed to find them leaking, and the cause at first may seem a mystery. Small perforations in the metal indicate corrosion, but why should pipes apparently nearly new be in this condition?

The division of Mineral Technology of the United States Museum has undertaken to collect data regarding the damage to gas- and water-pipes by stray electric currents, the chemical action of these currents being known as "electrolysis." The presence of street railway systems

carrying heavy currents in trolleys or third rails is held responsible for the damage, the return current in the rails partly escaping through the moist ground setting up measurable currents in the near-by pipes. Depending upon the character of the soil, the effect of electrolysis is more or less destructive.

What is the cure to prevent the pipes from being damaged? It has been found that, with a different method of insulation than that commonly employed in this country, the electrolysis of pipes can be practically stopped. The use of negative feeders carefully insulated compared with uninsulated feeders, shows that the lifetime of pipes in the neighborhood of street railway systems can be prolonged from twenty-five to fifty years, and economy of operation also attends the use of the insulated feeders.



This water-heater will chemically bring a bucket of water to the desired degree of temperature, within certain limits

Heating Water Without Any Fire

SET this water-heater in a bucket of water, turn the clamp at the top, and presto!—there will be hot water in a jiffy, and neither a coal or gas flame nor electricity furnishes the heat.

The principle of the chemical water-heater is simple. In the bottom of a cylinder is placed a quantity of unslacked lime, above which is an arrangement for supporting a compartment containing a weak solution of sulphuric acid. The pressure is transmitted downward by a slight turn of the bar-handle, and this operates to open a small hole in the bottom of the acid-chamber, permitting the acid to trickle downward upon the unslacked lime. The chemical reaction liberates heat sufficiently to bring the water to a high degree of temperature.

To renew the life of this chemical heater one has but to put fresh acid and lime in the compartments. Such liquids in small quantity as are required to be gradually brought to a certain degree of temperature can be satisfactorily heated by this method.



Planting strawberries with a punch and tongs. He punches the hole with the tool in his left hand and plants with the tongs



When strawberries are transplanted for bearing, they are carried in sacks to protect them from sun and wind

Improving the Harvesting of Sugar-Beets

TURN on the gasoline, take charge of the steering lever, steer straight along the row of hidden sugar-beets, and see what happens. An automatic hand of metal reaches down into the ground and clutches the beets, while a knife cuts off the tops, lifts them out by the roots, and finally stacks them along neatly where they can be collected. The old method of pulling up the beets by hand and topping them costs more than three times as much to an acre as machine harvesting does.

Real horsepower can also be used instead of horsepower merely translated into the energy of gasoline engines. The form of harvester that is adapted to be pulled by a horse also tops the beets

and then lifts them out of the ground. A thin knife of steel automatically performs the duty.

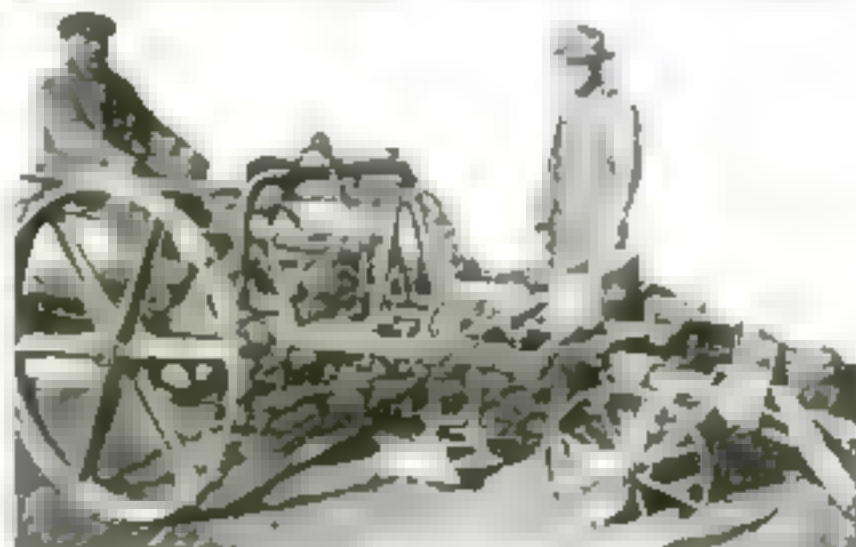
The under-works of the automatic harvester is a busy place, if one watches it as the machine is driven, either by "horse" horsepower or by gas-engine power. First the sharp undulated blades attached to the topping device press into the leaves, holding the crown of the beet against the knife. Pullers are immediately behind and in line with the topper, revolving as the machine moves. Penetrating the soil three or more inches, they pull the topped beets out of the ground and deliver them directly into the conveyor, which is so arranged that the beets are cleaned free from loose dirt and are sent practically clean into the hopper in a compact mass. From the hopper they are dumped in piles, to be collected later.

Follow the sugar-beet harvester and see the result of its service. When one thinks about the vast tracts of land that can be profitably planted in sugar-beets, it is interesting to consider the part that improved machines can perform in the work of harvesting the crops.



The automatic sugar beet harvester driven by real "horsepower." It tops the beets and lifts them from the ground, depositing them in little piles

In this sugar beet harvester a gasoline engine furnishes the "horsepower." A revolving pulling device, exactly in line with the topping knife, pulls the topped beets out of the ground



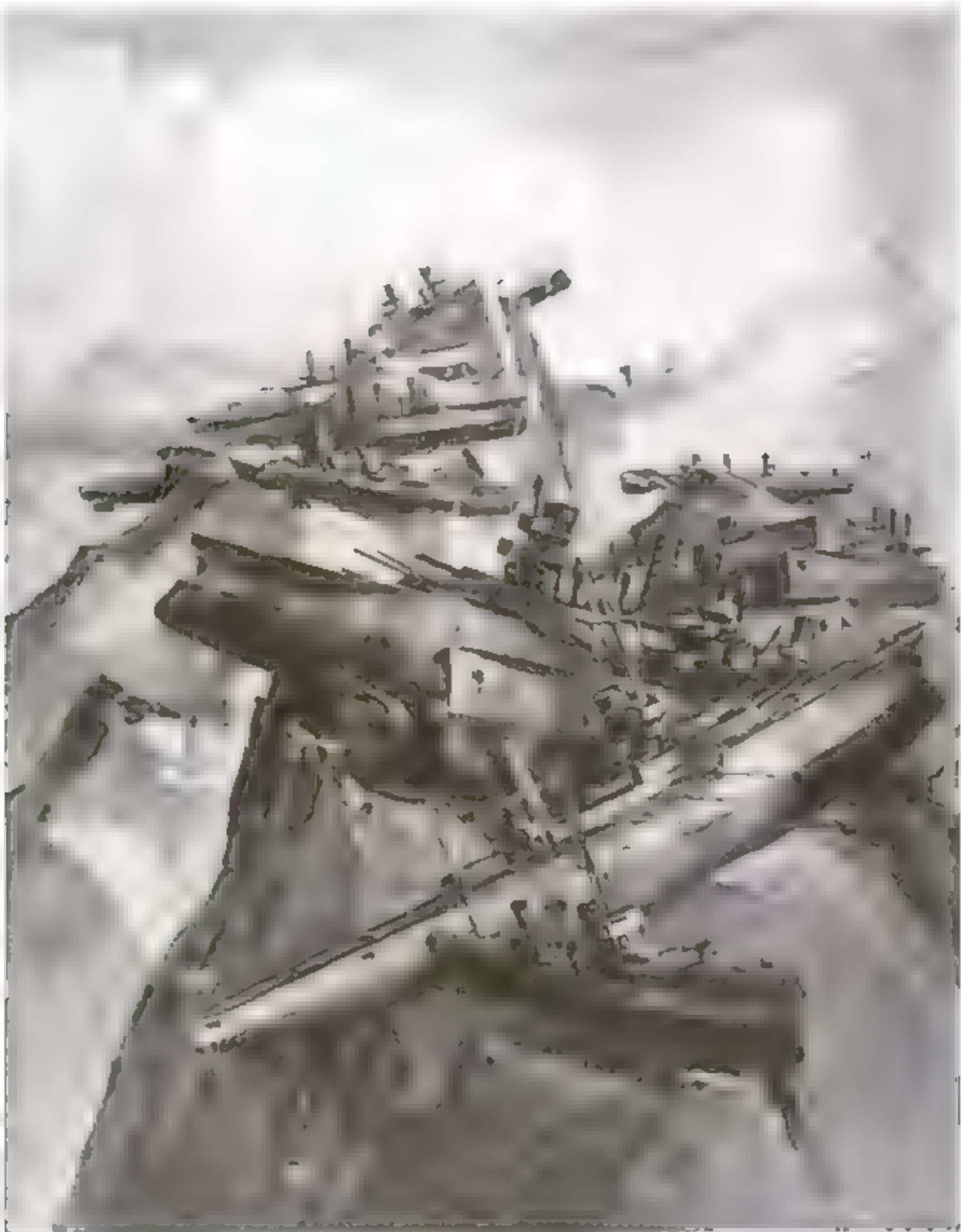
Stand Up to Plant Strawberries

WHEN you are eating a large, juicy strawberry, think of the stringy little plant it grew upon. A new way of setting these plants has been devised by a Maryland strawberry grower. He uses a punch for making the hole in the ground, and tongs for dropping the plant in the hole. Then he smooths the ground over with his foot. With the punch in one hand and the tongs in the other, he works very rapidly.

When the plants have five or six leaves they are transplanted to fine, rich soil for bearing. During the process of transplanting they must be carefully protected against wind and sun. In the South, where many of our strawberries come from, the farm-hands carry the young plants in old fertilizer-sacks. They slit the sacks near the top, and hang them around their necks. Then they make a second slit near the waist-line, through which they put in and take out the young plants.

Mildew and leaf-spot are the greatest enemies of the strawberry plant, but it is also attacked by the larvae of the garden moth and by the grubs of the cockchafer and the rosechafer.

When the fruit is ripe and ready to be picked, ground-beetles attack it. They hide in the ground all day and are very hard to catch. There is one good way of getting them, however. Food is placed in jars, and then the jars are turned upside down and sunk into the ground about an inch deep. When the beetles come up, attracted by the food, they become prisoners. Thus, you see, strawberry growing is not an easy task.



Is Sir Oliver Lodge Right About Atomic Energy?

Sir Oliver Lodge says that if the atomic energy in an ounce of matter could be utilized it would be sufficient to raise the German ships

sunk in the Scapa Flow and pile them on top of the Scottish mountains. 'I think,' he adds, 'we are on the brink of a great discovery.'

Dare We Use This Power?

Sir Oliver Lodge says atomic energy will supplant coal

By E. F. Richards

SIR OLIVER LODGE thinks that man is not yet civilized enough to use the energy hidden in ordinary matter.

"The time will come when atomic energy will take the place of coal as a source of power."

The man who spoke thus before the Royal Society of Arts in London was Sir Oliver Lodge, one of the towering figures in modern science, a man who has devoted the better part of his life to the study and interpretation of the atom. This new form of energy, which our great-grandchildren may utilize instead of oil and coal, has possibilities so appalling that Sir Oliver almost rejoices that we do not know how to release it. "I hope that the human race will not discover how to use this energy," he says, "until it has brains and morality enough to use it properly, because if the discovery is made by the wrong people this planet would be unsafe. A force utterly disproportionate to the present sources of power would be placed at the disposal of the world."

Sir J. J. Thomson, England's great authority on the atom, gives a picture of this terrible form energy that wins one over to Sir Oliver Lodge's view. He tells us that the atomic energy stored in an ounce of chlorine "is about the amount of work required to keep the *Maxwellia* going at full speed for a week," and that the splitting up of the atoms in any substance would involve enormous transformations of energy. "In fact, the explosion of the atoms in a few pounds of material might be sufficient to shatter a continent."

Everything Is Made Up of Atoms

These eminent men of science have no particular atom in mind when they speak thus of the fearful possibilities of atomic energy. They mean the atoms of any familiar thing—radium,

iron, copper, wood, or stone. The food we eat is made of atoms, and so are the tables and chairs in our houses. Every one of us, then, looks up within himself immense stores of

of as beta particles or electrons, were subsequently found to be given off also by radium, as one of the products of the breaking up of its atoms. For, though the atom ordinarily remains undivided, we know today that it is not indivisible. In certain cases the atom breaks up of its own accord, as in the case of radium, shooting off the fragments at speeds which make a rifle bullet appear like a snail in comparison.

Action Radium Particles

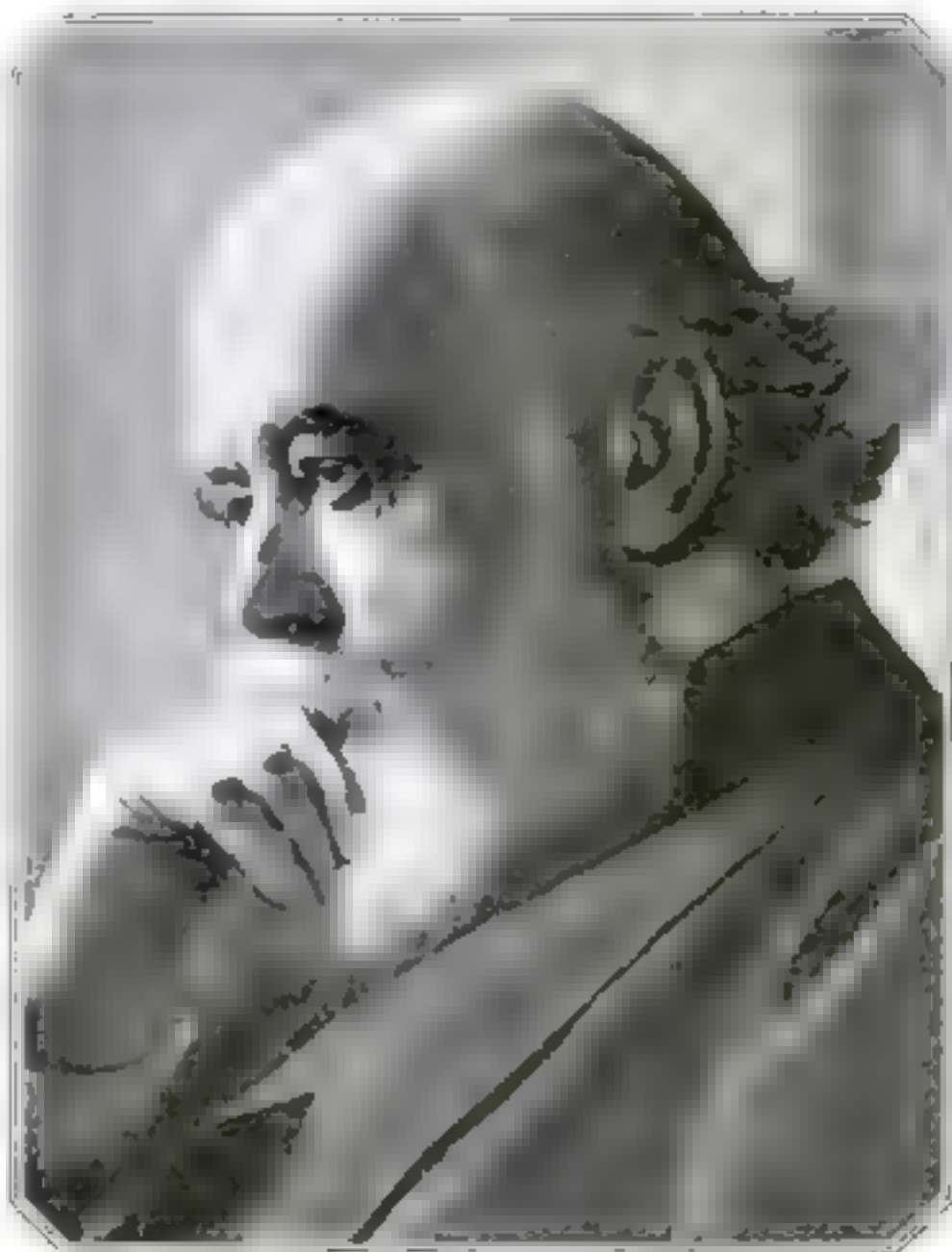
There are, indeed, good grounds for suspecting that all matter, not only radium, is thus shooting off particles and giving out energy. But we become conscious of the fact only in the case of radium and a few other radioactive substances. Radium is giving up its atomic energy more rapidly and more violently than limestone, for example, which explains why it seems more explosive than other elements. A radium atom is like a two-ton gun firing a hundred-pound shot. Just like the gun, the rest of the atom recoils after having been fired. This is not merely a speculation, a picturesque guess. The recoil has actually been observed. After five such projectiles have been fired, radium settles

down into another existence—a quieter existence, such as lead or something chemically like it. A uranium atom fires off four such projectiles in order to become radium.

Were the Old Alchemists Right?

All this is definitely known. The old alchemists were not so far wrong when they dreamed of turning iron into gold. Nature is constantly changing one element into another before our very eyes. When we know how to control the electron in an atom we may be able to make gold out of base metal at will.

Two kinds of projectiles are fired off



© International Film Service

"I hope the human race will not discover how to use this energy until it has brains and morality enough to use it properly," says Sir Oliver Lodge, in explaining the terrible possibilities that lie not only in radium but in a piece of wood or iron

energy. In a little finger there is enough energy to run all the trains in the United States for a few minutes, if we could but release it. The high explosives detonated to hurl millions of shells during a campaign are not so terrific in their possibilities as the atoms of which our bodies are composed.

The first intimation of the fundamental facts upon which the modern conception of the atom is based came to us through the study of X-ray tubes. In these Sir J. J. Thomson discovered particles weighing two thousand times less than the lightest atom then known, the hydrogen atom. These particles, which we now speak

by a substance—the heavy shot or alpha particle, which is known to be a helium atom, and the lighter shot or beta particle, which has been found to be the fundamental unit of electricity, an electron. An alpha particle is a sort of emancipated atom. It is fired off at a speed of 10,000 miles a second.

Where does the alpha particle get this terrific velocity? From an explosion. Not an ordinary explosion, however. The explosion of such a substance as nitroglycerine, for example, might be likened to the crash of a house collapsing. But the disintegration of radium in which alpha particles have their birth is different. It is more like the continuous sputter of a machine-gun; for in this case the "house" gradually crumbles from the explosion, one by one, of the bricks of which it is built up.

Heat Given Off by Radium

The process is not a hasty one. If someone had started off a pound of radium in the year one of our present reckoning, it would by now, in the year 1920, be just about half gone. And yet, so small are the individual bricks or atoms that, even with this slow rate of crumbling, from every grain of radium something over two thousand million bricks explode every second! And as the fragments, the alpha particles, fly off with a velocity of about 10,000 miles a second, no wonder that a considerable amount of heat is produced in the process. In point of fact, every grain of radium, in this disintegration, gives off in one hour enough heat to melt more than one and a half times its own weight of ice. As this goes on for some 2,700 years, on an average, it will be seen that radium is a most concentrated source of energy.

It is a plausible supposition that all substances behave in this way, only we do not perceive it because their disintegration is exceedingly slow even as compared with that of radium, which, as we saw, extends over thousands of years. We cannot, from the seemingly inert character of such substances as gold, for example, conclude that they contain no latent source of energy. Appearances are deceptive. Gunpowder looks harmless, too. And atoms of the ordinary chair on which you are now sitting, or of the paper of which the POPULAR SCIENCE MONTHLY is composed, may be more fearfully energetic than gunpowder or nitroglycerine.

Where does all this energy come from? No one knows. But we can draw a picture of an atom that will give one some idea. An atom is a miniature solar system. There is a central positive nucleus, like the sun, and a revolving system of negative electrons, like planets.

No one knows what the nucleus, the central sun, is. The revolving electrons are alike in all substances. The hydrogen atom is composed of electrons just like the electrons of iron. Electrons always repel each other. An atom is probably about one hundred thousand times as large in diameter as an electron. Roughly speaking, the diameter of the electron is about as large, compared with the diameter of the atom, as the diameter of our earth compared with the diameter of the orbit in which it travels around the sun. The hydrogen atom probably consists of a nucleus and one electron revolving around it. Uranium has at least 92 electrons. All the possible elements lie between hydrogen and uranium.

These electrons revolve at terrific speeds in their orbits. Every now

and then an electron or alpha particle, or both, are ejected. The speed of ejection is such that, weight for weight, an alpha particle has millions of times more energy than a bullet. A milligram of radium, an infinitesimal pinch, projects about thirty-six million projectiles a second. The alpha particle, with its speed of 10,000 miles a second, moves fast and strikes hard.

Terrific Speed of Electrons

But what shall be said of the speed of the electrons of which the alpha particle is composed? They travel almost as fast as light—186,000 miles a second. How is it that ordinarily we receive no evidence of these electrons moving within the atom? A smoothly running flywheel appears to be at rest. But when it bursts we know that it must have been turning. In the same way, since the motion of the electrons in the atom does not ordinarily become observable to us, when the atom explodes and throws off fragments at unheard-of speeds, we are puzzled until we realize that perhaps the motion existed before, within the atom, but escaped our view.

It is easy to see that if atoms are composed of nuclei and electrons revolving at stupendous speeds they must contain enormous stores of energy. Sir Oliver Lodge has said that if the atomic energy in an ounce of matter could be utilized it would be sufficient to raise the German ships sunk in the Scapa Flow and pile them on top of the Scottish mountains.

"I think," he says, "that we are on the brink of a great discovery. It may take a century. Our descendants, instead of burning one thousand tons of coal, will take energy out of an ounce or two of matter."

Fingerprinting the Chimpanzee

NO wonder that Joe, the chimpanzee, looks worried. They are taking his fingerprints. And while they do it Joe thinks of all the deadly deeds in his past, and tries to de-

termine which one they're following up. 'Tis true, his keeper is petting him while Maurice W. Fitzgerald, a government fingerprint expert, does the work; but Joe puts no faith in that.

He need not have worried, though. The fingerprinting was done for the sake of comparison with the fingerprints of men. Does each chimpanzee, as in the case of man, have his own particular brand? This question and others like it will soon be answered.

Joe's home, by the way, is in Central Park, New York city.

The ridges that appear on the fingers and toes of men and monkeys are supposed to be there to increase the sensitiveness and firmness of our grasp, a certain amount of friction being caused by these ridges. The chimpanzee's prints are much like man's.



It's not the sign of the "Black Hand" but a picture of Joe's fingerprints

Joe, the chimpanzee, is being fingerprinted. No, he hasn't murdered anybody; his prints will be used for comparison with the fingerprints of men.



Saving \$50,000 by Welding



WHEN the huge army transport *Northern Pacific* ran aground in a fog and sustained a fracture in the giant steel stern-post, to avoid delay and an expense exceeding \$50,000 in making a new casting, the officials in charge decided to resort to a thermit weld. Now, what is thermit? The greed of aluminum and certain other materials for oxygen is the basis of thermit. When granulated aluminum powder finely ground is mixed with powdered oxide of iron, and when heat is applied in sufficient quantity to the mixture, a reaction is started which rapidly gathers enormous heat and spreads quickly through the whole mass, melting the iron in about thirty seconds. A temperature between 2,600 and 3,000 degrees is raised, second in intensity only to the temperature of an electric arc, and nearly half as hot as the sun itself. A mixture of calcium and silicon and mixtures of other substances also can be used in thermit the best kind of material being determined by the character of the work to be done. The fracture in the wrecked vessel was 20 feet above the floor of the dry-dock, so a scaffold and platform had to be constructed. The next step in repairing the vessel was to cut a three-inch gap in the steel with an oxyacetylene torch, the gap to admit the entrance of the molten thermit steel. A wax pattern was built in the gap, 67 pounds of wax being used



The spectacular part of the process came when all was ready and the thermit was ignited. This was preceded by heating the parts to be welded with gasoline torches. The heating required seven hours. Two men, standing on ladders, simultaneously ignited the powder and climbed down to safety. Then the tapping pins of the crucibles were knocked out 45 seconds later, and the molten steel flowed into the fracture, welding it with a fine grade of steel

A mold box large enough to hold 40 barrels of molding material was constructed 10 feet in length, 51 inches long on the side parallel with the ship, and 48 inches above the platform. Openings for preheating the fractured parts were arranged, and gates into which the molten steel could flow were provided. The intense heat would come from 1,400 pounds of thermit divided between two huge crucibles on each side of the mold box. As a precaution against fire the chains were wrapped in asbestos, and sheets of this material were placed between the crucibles and the hull of the ship, and the platform below was sprinkled with sand. Then the thermit was poured in



What Happens When a Great City Suddenly

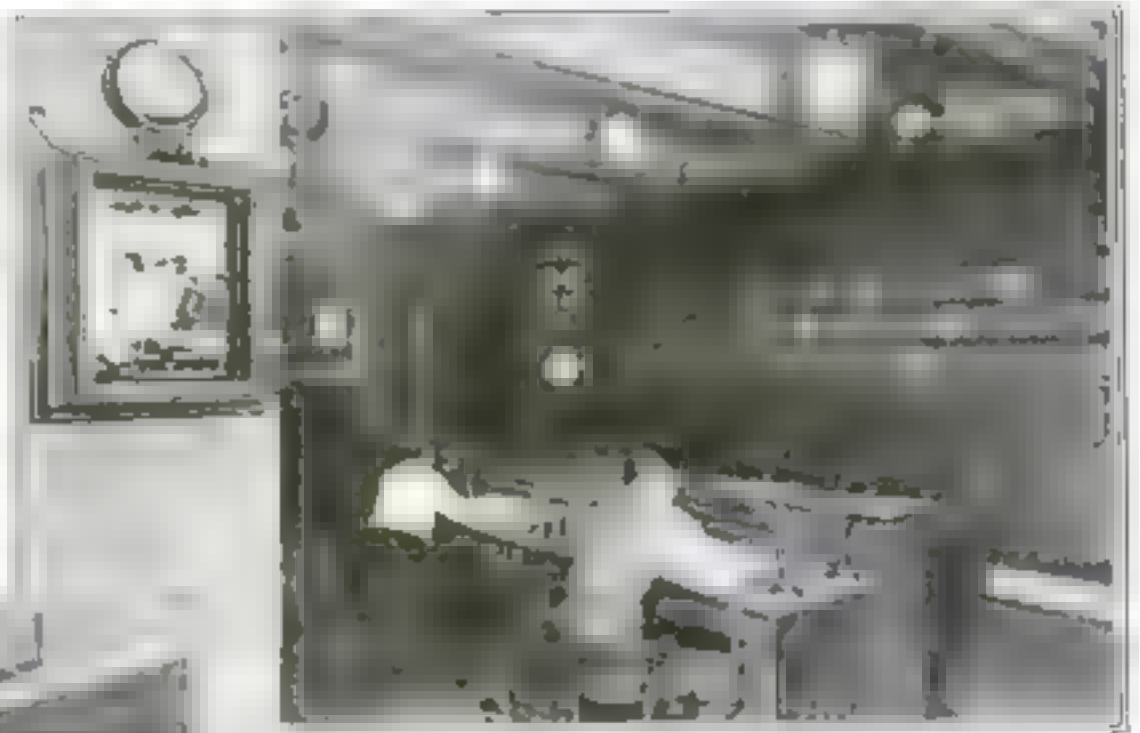
Photographs by courtesy of



"Looks like a storm coming," says the weather-wise business man, whose perch is the top floor of a skyscraper. Other people far down behind the windowed walls notice that it is getting dark, but they can see little of the storm that is approaching, because their view of the sky is limited. Then suddenly all the great city realizes that it has become dark in the middle of the afternoon. "Click! Click!" go the buttons turning on the electric lights, and

the burden of instantly supplying about 175,000 additional horsepower is thrown upon Waterade, the generating station of the New York Edison Company. What would happen if preparation had not been made to meet such a huge demand? Either no lights could be furnished the darkened city or other power would have to be cut off. In other words, the coming of a severe storm would tie up the business of the city until conditions again became normal.

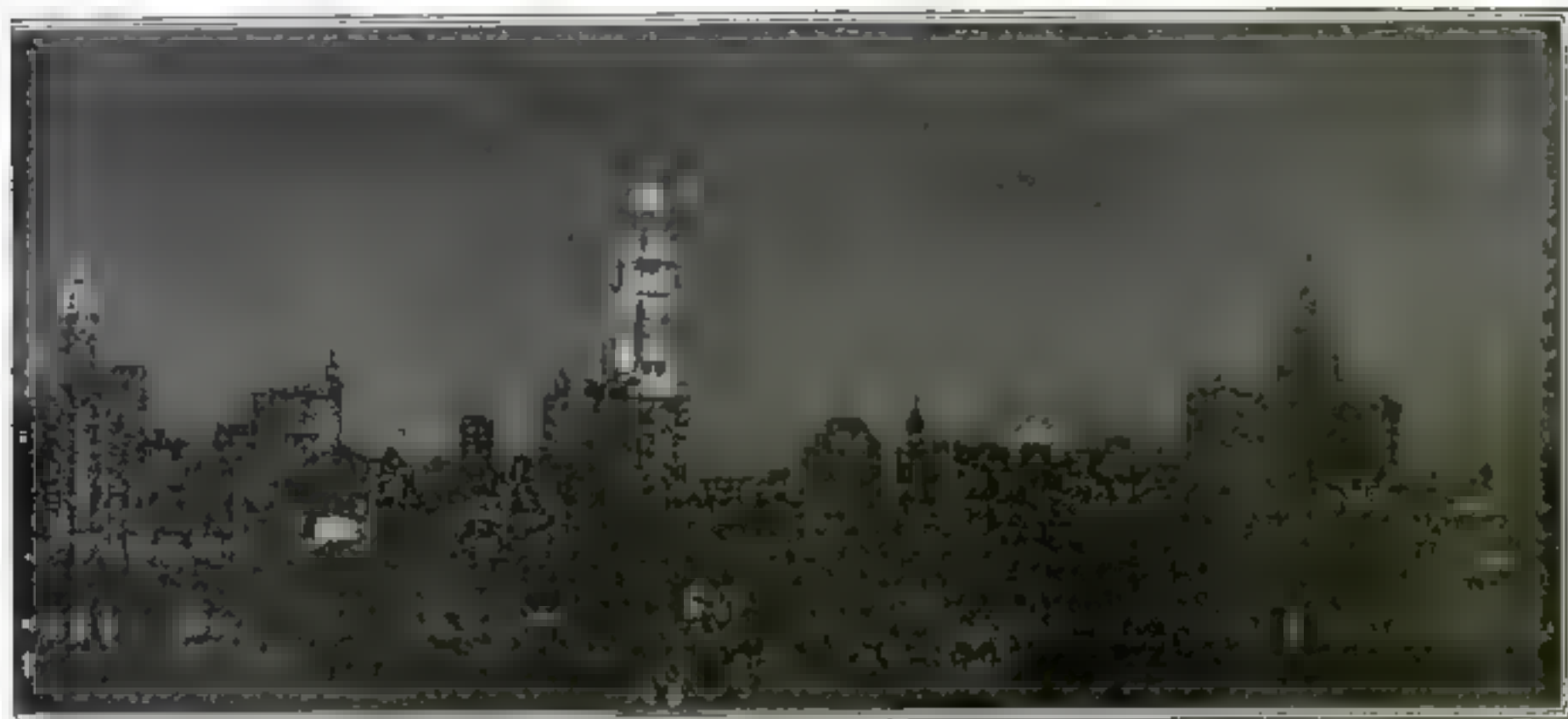
When two or three lights are suddenly switched on during the day when the greatest amount of light is needed, the demand for power is increased. The approach of the storm clouds is announced by an ingenious device, the "wireless storm alarm." A series of bells, which are connected with the power lines, begin to ring when the storm is near. The bells are arranged in a series of twenty miles and as the storm draws nearer the ringing becomes more frequent. Some of the bells are arranged in a series of twenty miles and as the storm draws nearer the ringing becomes more frequent. Some of the bells are arranged in a series of twenty miles and as the storm draws nearer the ringing becomes more frequent.



May, 1920

Turns on Two Million Lights to Meet a Storm

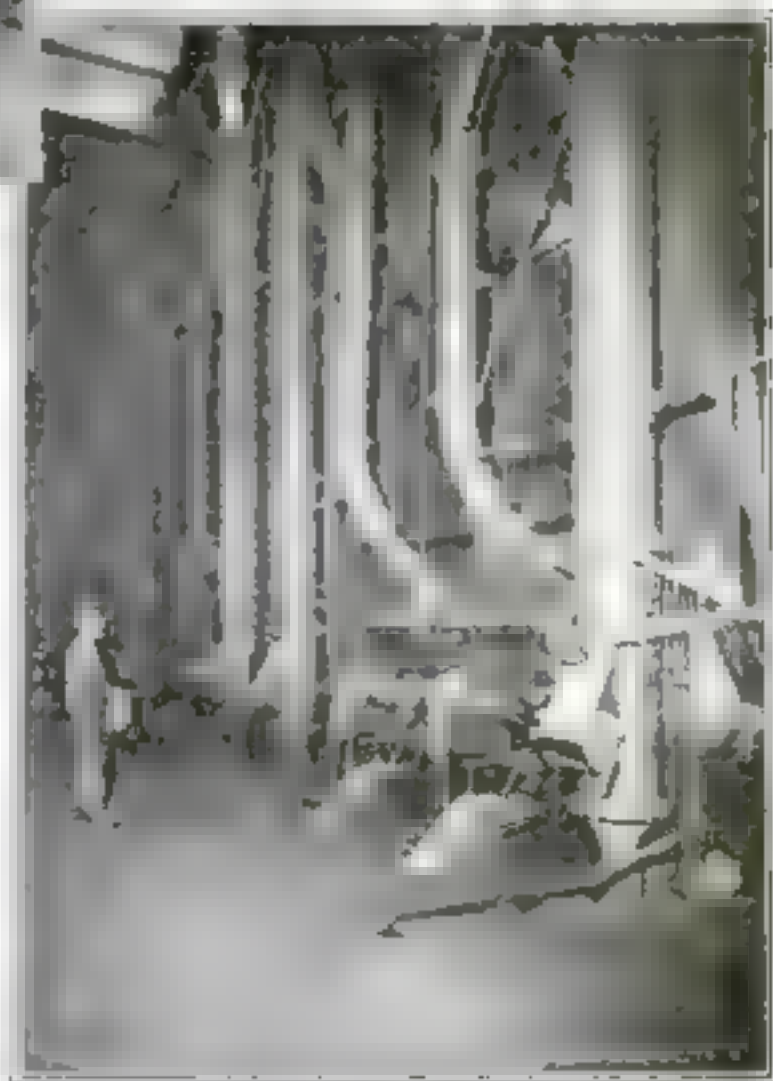
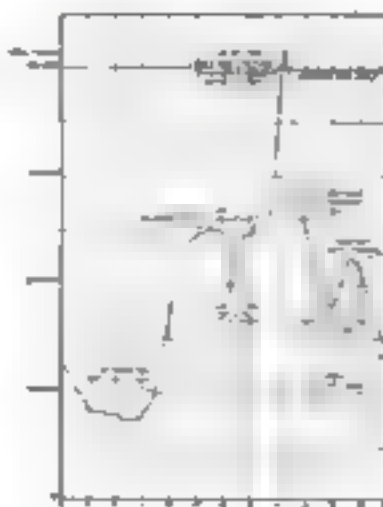
The New York Edison Company



Imagine a score or more of men stoking the fires of the huge electric power plant, to beat the approaching storm in the race toward darkness! That is what would have to be done were it not for the fact that the New York Edison Company at its Waterside station employs only automatic stokers. The whole operation of sending fuel into the fires under the boilers is automatically conducted under the guidance of a few intelligent workmen. The hard conditions and the strain of the storm are borne, not by human beings, but by the steel of machines. From the unloading of the coal from the barges, to the removal of the ashes, the process is carried on almost entirely by mechanical means.

As the storm swoops down and the sky darkens, there is strict attention in the room where the indicators are arranged. Watchful eyes are turned toward the numbers of dials on the wall. Every district must be looked after and its requirements fully provided for in advance. Nothing is overdone, but enough electricity must be generated to meet the requirements. Both generators and storage batteries may be called to the rescue when a severe storm prevails, so the close watchfulness by the men before the indicators interprets the story told by the instruments, and the action of the plant follows.

When the wheels of activity are whirling to generate the extra load of electricity needed to overcome the darkness of the thunder-storm, what does the effort really mean in the terms of figures? On a day (June 20, 1919) when the record storm of the year occurred, one sees at 5 A. M. about 75,000 horsepower being used by the city. The low ebb of Edison power was at hand. By the time the factories opened at 8 o'clock, about 165,000 horsepower were being drawn upon, while at 11 A. M. there were slightly more than 250,000 horsepower. The highest point reached in the afternoon would normally have been about 250,000 or 275,000 horsepower; but the extra load brought about by the storm caused the amount to jump suddenly up to about 425,000 horsepower! The huge increase, 175,000 horsepower, had to be prepared with scarcely an hour's notice.





Signor Luigi Fortoni has invented a typewriter that will register notes of music

Music on the Typewriter

LETTERS, numbers, and figures are not the only things that can be registered on the typewriter. It can also register music, as Signor Luigi Fortoni has proved. He has invented a rapid music writer and is shown here using the machine.

There are but ten keys on the music keyboard, yet with them it is possible to print with precision all the different characters, together with their alphabetical letters, in two sizes. The notes are given their correct length, and transposition from key to key is made possible.

Wetting the Air

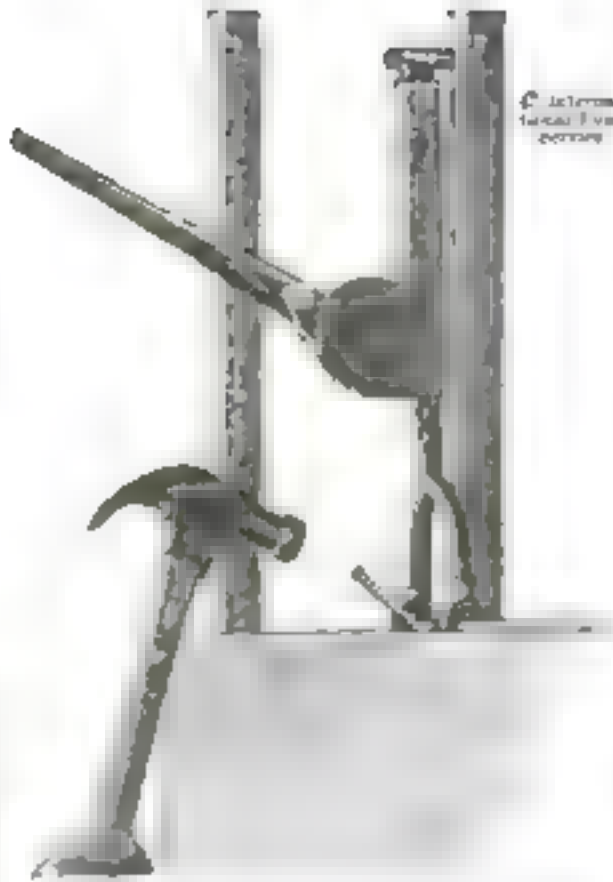
YOUR hands feel hot and dry if you sit in a room where there is not sufficient moisture. True, you can place a pan of water on the radiator, but the water does not evaporate rapidly enough.

Ralph J. Patterson, of Berlin, N. H., has invented an electric humidifier. It is made of metal shaped like a satchel. It is partly filled with water. A few inches above the surface of the water is a cylindrical electric heater. A wick is looped across the heater, and both ends terminate in the water.

The water rises in the wick until it reaches the heater, whereupon it evaporates and escapes through air-holes in the lid. As soon as one group of molecules evaporate, another group run up the wick



As he makes the connection, an electric heater inside the humidifier becomes hot and evaporates the water in the wick



Place the sockets over the tongue of the board, and hammer in the spike

Use This Clamp on Those Warped Boards

THIS is a story of how suppressed irritation finally exploded and in so doing produced a floor-layer's clamp.

They were a good bunch of fellows—a volunteer crowd—and they were putting in their spare time repairing and redecorating the little Presbyterian church. Everybody knew everybody else, and they were having lots of fun over the job. There was just one fly in the ointment—the matched boards that they were using were warped. The only reason they didn't swear was because they were in church.

Ray Aylworth, the blacksmith, had become rather irritated over the job, and vowed he would make something to fix it. At the next session he turned up with a fearsome-looking tool that appeared to be a mixture of a pitchfork and an automobile jack.

The tool had a fork at one end, and each tine had a socket that fitted over the tongue of a matched board. At the other end was a spike that projected at right angles to the shaft of the tool. In the center was a handle and a toothed wheel, or pinion, working in a rack.

Ray asked somebody to place a badly warped board in position on the partly finished partition wall. He slipped the sockets of the fork over the tongue, and with a hammer gently tapped the spike into the two-by-four scantling. Then, by working the handle up and down a few times, he extended the rack like an automobile jack. Three or four strokes clamped the board so tightly that another stroke or so would have broken it. He then put a nail in between the tines and held the board firm. The same operation was repeated at the other uprights, and—presto!—the board was in place.

The clamp is adapted to many different kinds of work; it is inexpensive; it enables otherwise useless wood to be employed, and it is compact.



Hauling down the flag is accomplished by readjusting the pole

The Folding Flagpole

IN the picture above, the Stars and Stripes is flying on a flagpole only two feet high. The pole is one of the collapsible flagpoles recently invented by Fred Lindstaedt, of Fairmont, Minn.

The flagpole tapers from a broad base to a pointed top. But at the middle there is a short cylindrical section, at which place the pole is divided in two.

To lower the flag when evening comes, the upper half of the pole is pulled out of the lower half, turned upside down, and inserted, point first, into the lower half. The two cylindrical sections coincide once more and the pole is half its normal height.

A Hose Watering-Pot

WHEN the gentle rain from heaven falls to drop, you get out your watering-can—if you happen to own a garden—and fill it with water. To do this you hold it under a faucet and turn on the water. Your hand moves slightly, the water hits the guard on top of the pot instead of going in, shoots off at an angle, and lands on you. You are drenched and angry. But you are not the only one who has suffered this. Alice E. Wilt, of Philadelphia, had similar experiences and they inspired her to invent a new watering-pot.

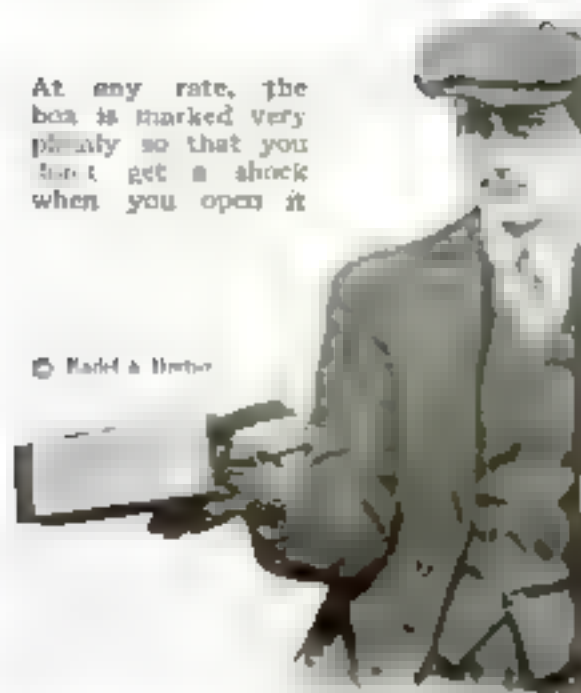
This pot is supplied with a pipe which goes through the top of the can, through the handle, and is threaded at the end so that an ordinary garden hose will screw into it. To fill it you need only screw and then turn on the hose. On one side of the can there is a holder for shears, and on the other side one for a trowel.



To fill up this watering pot turn on the hose

At any rate, the box is marked very plainly so that you don't get a shock when you open it

© Mabel A. Dyer



An Alligator in His Mail

NO wonder the mail service is what it is! It is no longer confined to modest letters with little red stamps in the corners. You can send almost anything by mail—alligators, for instance.

Nearly everyone who goes South for the winter sends a dear little baby alligator to some unfortunate relative up North—it's so useful! The alligators are shipped in small boxes that are very plainly labeled "Live Alligator."

Do you wonder that there is trouble in the post-office? If you were a post-man, how would you like to carry around on your back a bag full of squirming alligators?

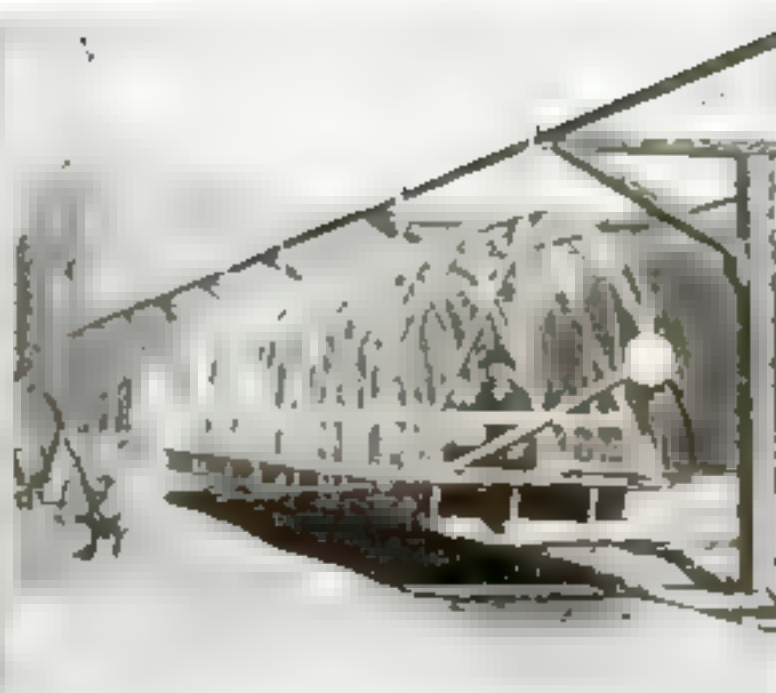


A Russian ambulance turned into a sled without taking off the wheels

From Wheels to Runners

IN Petrograd, when snow begins to fall, it is often convenient to put wheeled vehicles on runners. By means of an ingenious arrangement an ambulance is rapidly adjusted to the severe conditions of travel brought about by sudden changes in the weather. Instead of taking off the body of the wagon and fitting it to runners, a sled is employed that accommodates wheels and all.

Thus the ambulance is moved upon the sled and securely attached so that it will not roll off, and the tired horse is no doubt grateful for the change. When the snow and ice melt it is an easy matter to change back again to the wheels by merely moving the ambulance off the sled



A street-car equipped with a 26-horsepower engine and a powerful airplane propeller

Taking the Air in a Street-Car

TIMOROUS folk who have vowed that they never will ride in the propeller-driven airplane may retract enough to take a trip in the propeller-driven street-car.

In the city of Burbank, Cal., a steel and aluminum car, built to accommodate fifty-six people, hangs from a single track along which it runs supported by overhead wheels. A gasoline engine of twenty-six horsepower drives a powerful propeller, the shape of the car being constructed on the plan of a torpedo, cutting through the wind when speeding along at a lively rate.

The passengers are thus afforded an opportunity to realize how it feels to ride behind a powerful airplane propeller without being in danger of falling when the propeller stops.

It Does Away with the Services of the Caddie

A NEW golf-club holder invented by Edward Vogel, of San Francisco, is threatening the caddie business. It is much lighter than the usual golf-club bag, and it can be carried by the player himself.

It consists of several tubes—one for each club—fastened together at the top. The central tubes are much longer than the outside ones. The golfer slides his clubs down the tubes and carries them by a handle that fits over the arm. When he reaches the golf course he sets them up tripod fashion.



She carried her own clubs to the course, not in a heavy bag but in tubular cases joined together at the top



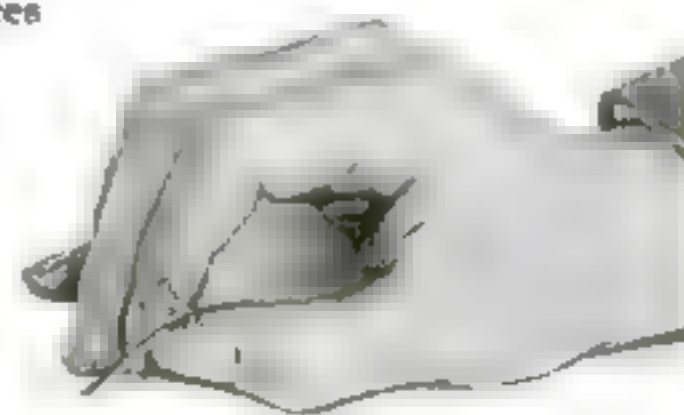
At first he thought it was real. It turned out to be made up of real kernels on an artificial cob

A Yard of Corn

"IT can't be real!" says the man above, as he looks at the monster ear of corn towering up in front of him.

And he is right. It is not a real ear, but a very cleverly constructed one. It is made up of the largest kernels brought forth by more than one hundred real ears, fastened to an imitation cob. It is more than a yard long, and has eighty-two rows of kernels with two hundred and twenty-five kernels to each row.

This artificial monster was exhibited at the recent Hay and Grain Show at Chicago.



A strange collar-button is this, made of a mortal bow-knot and a spear, linked together. The necktie holds it in place

The New Collar-Button

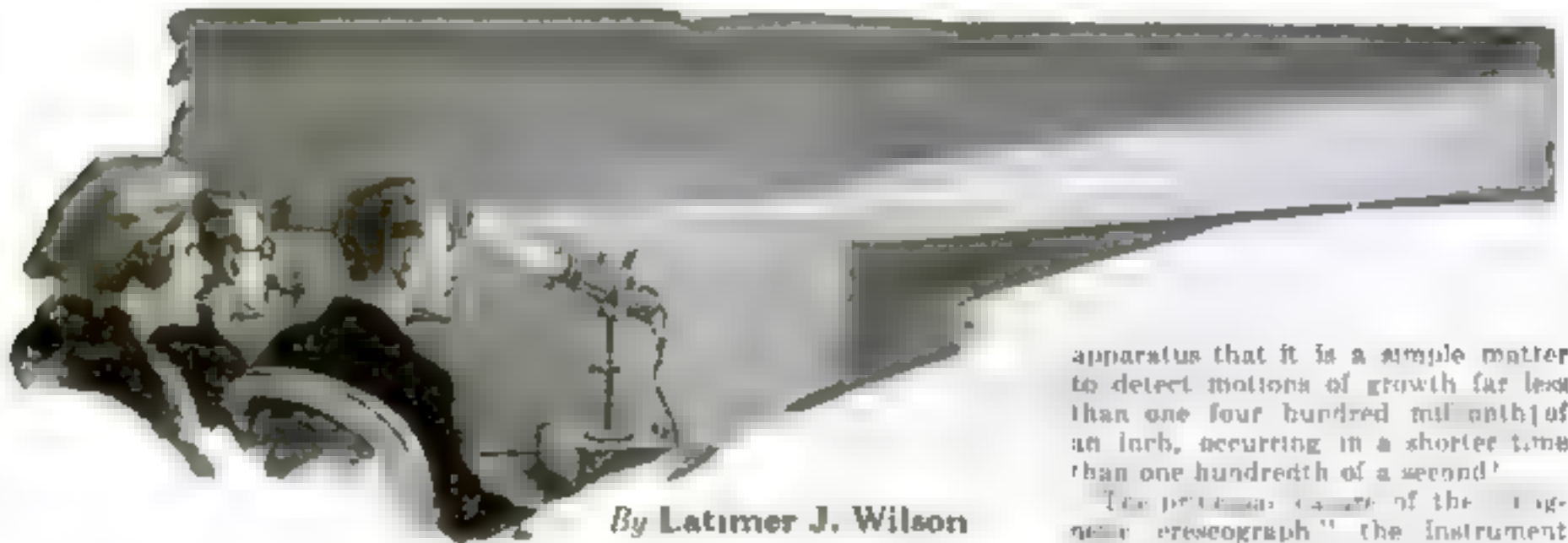
YOU'RE not the only man who grows in at collar-buttons. Robert V. Sampson, of Denver, grew so enraged at one that he took it and the collar it had torn to his work-bench, and sat down and glowered at them.

Before he got up he had planned an entirely new collar-button. It is made in two parts linked together at right angles to each other. The upper one is shaped like a bow-knot, and the lower one is long, straight, and pointed.

You thrust the point through shirt and collar as far as it will go, and then press it flat against your collar. The link makes this possible. When your necktie is firmly tied it will hold the spear in place.

Watching the Heart-Beats of a Plant

Sir Jagadis Chunder Bose, a Hindu scientist, has discovered a secret of nature



By Latimer J. Wilson

ATTACH a pen to a leaf and place a sheet of paper where the pen can move upon it freely. Then watch the leaf write in plain terms the most minute details of its passing sensations! Substitute a delicate magnetic apparatus for the mere crudity of a pen and the feat is accomplished: the dumb leaf will open its confidences to the eyes of man and indicate exactly how it responds to the influence of outside happenings.

He Reads the Thoughts of Plants

The man who has discovered the key to the innermost secrets of plant life, and who has exposed the very "life movements" of the trees, is Sir Jagadis Chunder Bose, founder of the Bose Research Institute of Calcutta, India.

The interested visitor who steps into the Institute at Calcutta will see a large tracing being automatically made in two curves. The first curve shows graphically the changes of temperature, the shifting effects of light and atmosphere that are taking place throughout the twenty-four hours of the day. The other curve shows the resulting effect in the response of a tree standing outside the building. The passing

cloud, the temperature change, the fall of a raindrop or the shifting wind—all are reflected in the heart-beats of the leaf!

Only the larger movements of plants were recorded by the first instruments invented by the Indian scientist, but continual improvements brought about a means of greatly magnifying the small motions, until finally the curious discovery was made that every plant, like every living animal, has a "heart-beat," rhythmic and regular, which indicates its state of health.

So delicate is the recording

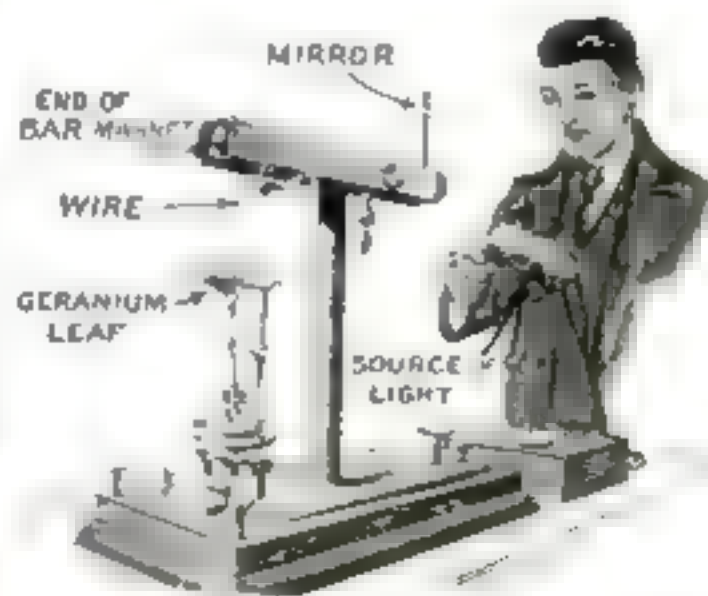
apparatus that it is a simple matter to detect motions of growth far less than one four hundred millionth of an inch, occurring in a shorter time than one hundredth of a second!

The principle of the "magnetic crescograph" the instrument that makes visible the pulse-beats of the plant, is a long magnetic lever, the short arm of which is attached by a cocoon-thread to the leaf. The other end of the lever is arranged to move in front of a magnetic needle to which a small mirror is attached.

The very slightest motion of the



How ether affects a plant. First is seen the normal response before the ether is admitted, then is seen the stoppage of pulsation due to the effect of the ether. When the ether is blown off, the rapid recovery of the "heart-beats" may be noted.



The magnetic crescograph, composed of a magnetic lever, a magnetic needle and a small mirror which reflects a beam of light, forming a spot of light upon the screen. The motion of this spot shows at a glance the pulse-beats of the leaf attached to the arm of the lever by a cocoon-thread.

The heart-beats of a plant. One sees on the screen a graphic line of motion illustrating the effect of poison on a plant. The line-waves diminish until at death they form a straight line and the spot of light on the screen then ceases to move.

thread-end of the magnetic lever meets with response from the needle with its attached mirror. When a beam of light is thrown on the mirror at an angle, it is reflected on a screen, and the slightest motion of the mirror shifts the spot of light. When the plant contracts under a shock, the movement is in a reverse direction; when the growth stops, the spot of light becomes stationary.

A magnification of ten million times is possible. If the human heart-beat were magnified to this extent at the rate of seventy-five beats a minute we would see about twelve million "palpitations" every second.

Explaining the Mysterious Mimosa

Ordinarily the records in the study of plant growth are not necessarily magnified so greatly, and instead of being thrown on a screen they are marked with a point delicately adjusted near a plate of smoked glass. Sir Jagadis



has observed various plants. The mimosa, well known as a "sensitive plant," is shown by the investigations to be merely more obviously sensitive than other plants.

The "nerve" of the mimosa leaflet, the *pulvinule*, corresponds in its up-and-down motion to the expansion and contraction of the animal heart. It is a "rhythmic tissue," the motion of which may be disclosed with light from the marvelous crescograph.

At the top of the mimosa may be found the youngest leaflets, while the mature leaves occupy the middle zone of the tree. At the bottom are the aged leaves. Investigations were made separately to find just how the age of leaves determines their response to stimulation and their recovery from shock. The effect was found to be very similar to what might be expected in animal life—the young and the very old differing greatly from the mature adults in their response to stimulation.

Did You Know that Plants Sleep?

What is the effect of cold on the heart-beats of plants? Sir Jagadis has found that intense cold paralyzes the action of the rhythmic tissues. In ordinary cold weather the trees that are acclimated merely "hibernate," when the leaves die. But the most astonishing result of his investigations is the disclosure that plants, like animals, actually sleep. During the period of rest there is a decided difference in the heart-beat of the leaflet from that of its waking hours. In its resting hours the plant is less capable of excitation, and, curiously enough, the resting time of the mimosa is from evening to morning. Its waking up time is about 8 A. M., and the maximum of activity is reached at from 1 to 3 P. M.

The Indian plant *Desmodium gyrans* has furnished many experiments. Its pulse-beats range from one- to two-minute intervals. A leaflet immersed in water was kept in a dim room for forty-eight hours before its heart-beats stopped. A cut leaf generally retains its rhythmic life-movements for a similar interval, at the end of which it can be revived by stimulants. The arrested growth of plants may also be revived by stimulation.

But what are the practical results to be obtained from the wonderful investigations conducted at the Research Institute? The more we know about plants the more we know about agriculture. It is no longer necessary to wait months, even years, to discover under what conditions plants thrive best. The crescograph answers our questions in a few minutes. Moreover, much light is shed on the life processes of higher animals. Highly

from shock, the effects of various stimulants, can all be seen in the high magnification provided by the magnetic crescograph.

When stimulated, the heart-beats of a plant become enhanced in size. Depressed with poison, they dwindle in size until the cause is removed, and if not removed the death spasm is seen in the quivering writing of the recording instrument, when the heart-beat stops. This physiological effect of drugs on the simple life-movements is regarded by physicians as leading to an important advancement in the science of medicine. It is possible to test the effect of drugs in a far simpler manner than that employed upon the higher forms of animal life.

Reading the Life of a Leaf

How interesting to sit in the darkened auditorium and to watch the screen upon which the crescograph is writing the autobiography of a leaf! In a vertical direction the spot of light oscillates. Gradually the audience becomes aware of a change that is taking place. There is a diminishing motion in the wavering image of the light reflected from the small mirror. Is the leaf about to expire?

The lecturer explains that the leaf is under the influence of an anesthetic. Ether has reduced its state of sensibility, and its normal heart-beats have temporarily stopped. When the fumes of ether are blown away, the pulsations begin. At first they are very small and weak, but gradually the spot of light begins to swing upward and downward in the rhythmic form similar to that of the normal motion.

One of the most interesting applications of Sir Jagadis' discovery was recently tried on a tree that was supposedly impossible to transplant. Previous attempts to transplant other trees of its kind had resulted in the death of the plant. Working on the theory that the shock had proved too great for the sensitive plant, the tree was subjected to the effects of ether during the operation. When it recovered from the ether after the replanting had occurred, the tree first shed its leaves, but it lived.

Precisely as in the case of animals, an anesthesia proved beneficial in easing the shock of the operation.



Courtesy of Hollinger

Sir Jagadis Chunder Bose is imbued with all the mysticism of the East, and yet he is an exact scientist in the fullest sense. His wonderful instrumental study of matter, living and non living, has made him more of a Hindu than ever. It was when I came upon the mute witness of these self made records, and perceived in them one phase of a pervading unity that bears within it all things—the mote that quivers in ripples of light—the teeming life upon our earth, and the radiant sun—it was then I understood for the first time a little of that message proclaimed by my ancestors on the banks of the Ganges thirty centuries ago.

developed forms of life, such as are reached in the animal world, are so complex that much difficulty attends their isolation.

To study the effects of disease and the results of remedies in the simplest life-forms would be of great benefit when adapted to the higher forms. Life is ephemeral in animals, compared with that of plants. Man's fourscore years and ten is a puny age compared with the 5,000-year-old sequoias! Thus in the recorded pulse-beat of the plant can be observed the primitive problems of life. The effects of various drugs, the depression or the recovery



The traveling players and their play-house are carried around the country in a motor-truck.



The baseball team of the House of David are sportsmen, though they are not athletes.

Again the Traveling Players

IN the days of Shakespeare's traveling players went from town to town, carrying their costumes in a bag, and playing their plays in any old barn they could get. Today we again have traveling players, but they travel in state. The War Camp Community Service of the District of Columbia manages them.

A powerful motor-truck draws behind it a large play-house on wheels. Inside there are dressing-rooms, space for the scenery and the stage itself. The actors ride in the truck.

The first performances were given for the benefit of charitable institutions. But the play-house was too frail to withstand the jolts it received, and it is now being rebuilt.

Armor for Plants

TO protect young plants against cutting insects and other injurious pests, a shield of "armor" has been invented for the growing plant. A piece of metal or flexible material rolled into a cylindrical form is put at the top so that strips can be curled outward and offered as an obstruction to the army of insects that advance from the ground.

The device is easily applied, and provides an impenetrable barrier to the insects. It also serves to shield the plant from dangerous winds. The same principle may be employed in a larger device to be applied to fruit trees.



The armor to be clamped around the stem of the plant, to protect it from damaging insects.

The armor clamped into position around a young plant, making it proof against strong winds and cutting insects.



The Strawberry Barrel

"STRAWBERRIES, fifteen cents a quart," shouts the peddler in the street.

You get out your fifteen cents and buy a box because they are so cheap. But they are not nearly so cheap as they would be if you grew your own—and you don't even need a garden to grow them in. A barrel will do just as well.

Look at the barrel shown below. It has strawberry plants growing out of its sides and its top, and enough strawberries come to life on them to supply a small-sized family for a whole summer.

To make this garden, take an old flour-barrel, fill it with rich, loamy soil, and bore a one-inch hole in it every six inches. Into these holes thrust young strawberry plants. They will thrive just as they would under normal conditions, provided they get sufficient sunlight and water.



This barrel supports strawberries all summer.

What Lovely Tresses!

WHEN the wind doesn't blow too hard, the ball team of the House of David, a religious order at Benton Harbor, Mich.—will hold its own against any team. But on windy days the long tresses of the players blow into their bearded faces and they are greatly handicapped.

Long hair and beards are among the religious customs of the order. Nevertheless the ball-players are regular chaps, and they have won many games played with semi-professional teams. One of the players—Mooney—is so good that he is to be given a trial by the Chicago Cubs. The manager, Francis Thorpe, is taking the team on the road this season.

A long-haired band travels with the players and furnishes music at the games.

Riding the Ostrich

AN ostrich may be foolish enough to put its head in the sand when it is being chased and think it is safe; but when a man actually jumps on its back, it runs and runs swiftly.

At an ostrich farm in Florida you can ride an ostrich around the race-track for the small sum of fifty cents—provided you don't weigh more than one hundred and fifty pounds. That's as much weight as an ostrich will carry on its back—though it will pull four hundred pounds in a cart.

When you mount the ostrich a sock is pulled over its head—it feels safer in the dark. When the sock is pulled off it leaps forward. You grab the feathers and hang on while the ostrich races around the track with you. It can easily beat a horse in a long-distance race.

Riding an ostrich around the race track is a new sport. It doesn't wear a harness; you simply hang on to its feathers.

© E. A. Dyer.



Baggage, not bombs, go in this airplane's capacious maw

The Baggage-Room of an Airplane

THE baggage-room of a railway train is a dark and gloomy place. Many a passenger has wept at the thought of putting her pet dog in it. But the baggage-coach of an airplane is not by any means a cold, gloomy place. In fact, it is apt to be very warm, since it is often located near the engine.

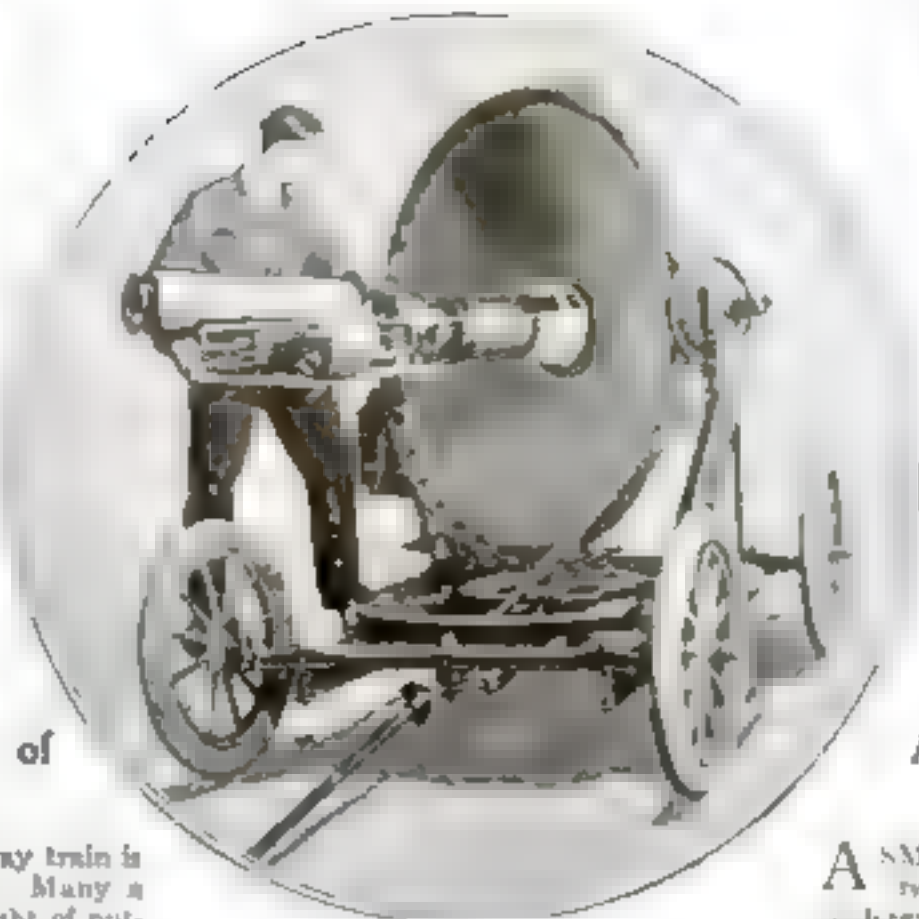
The picture above shows a regular porter stowing away baggage in the front end of a French passenger airplane. The owner of the bags may be seen climbing in the rear.

Compare the present-day airplane, with its space for pilot, observer, passengers, and even baggage, with the airplane of ten years ago.

She's a Truck-Driver

BE careful what you say about truck-drivers in general, hereafter. They are not all huge persons with large swearing vocabularies. Here is one, for instance, who is both charming and soft-speaking. Her name is Luella Bates and she lives in Clintonville, Wis.

Not only does she drive her own truck, but she does all of the repairing herself. She and her truck are shown below.



A portable searchlight that will throw a beam of dazzling light a distance of ninety miles. It can be wheeled into any position and the angle of the light accordingly regulated

Throwing Light from New York to Philadelphia

IN trying out a new portable searchlight it was found that a dazzling beam of light can be thrown from New York to Philadelphia, a distance of ninety miles. The source of light is a carbon arc drawing a current of 150 amperes at a pressure of 75 volts.

A concave parabolic reflector forms the rays into a brilliant beam and projects it with great power along the length of its course through the night air.

The portable feature of the searchlight is interesting because of the ease with which it can be operated. The entire mechanism can be rotated on a horizontal axis; besides this, the car upon which the powerful light is carried can be turned as easily as the light itself, in any direction.



In this smoke-house smoke percolates through a vent in the floor

A Smoke-House that Will Not Burn

A SMOKE-HOUSE built of slabs of concrete instead of logs, and having an underground channel through which the smoke can be drawn from a fire built outside, is an innovation in smoke-houses, constructed by Mr. Fred Traub, of Doon, Ia.

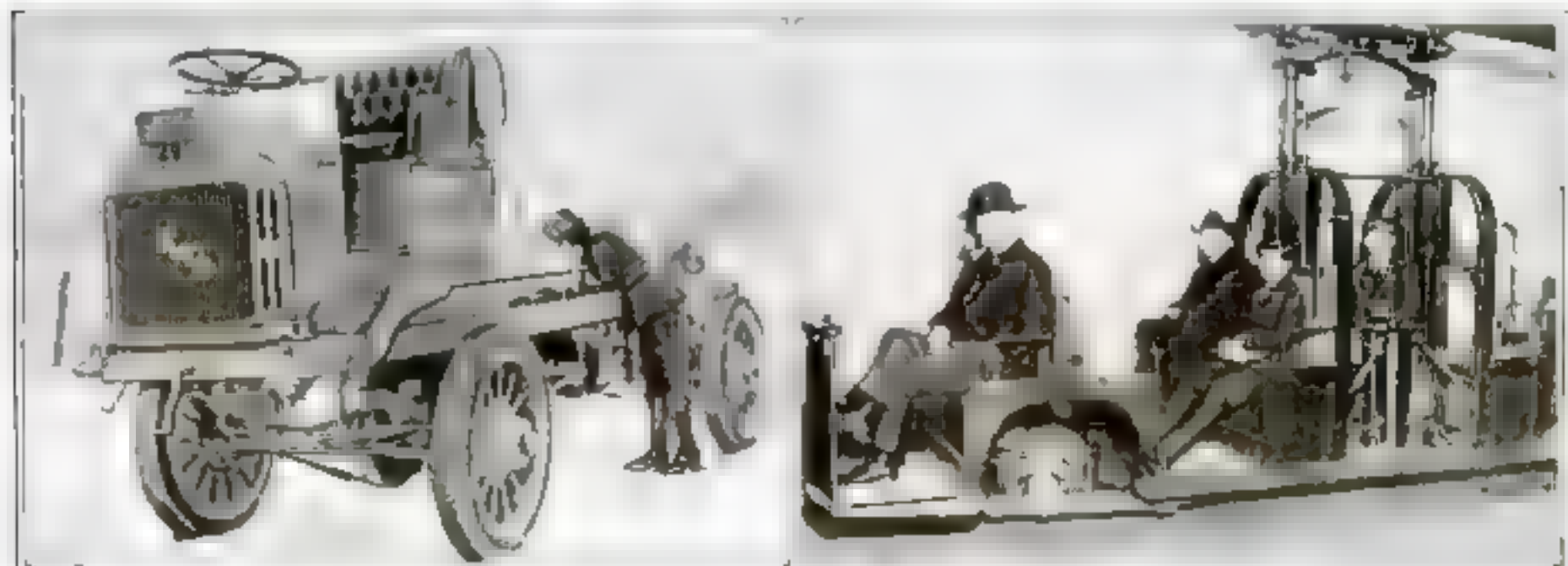
The heat from the fire is partly lost in the passage of the smoke through the underneath vent, an advantage in smoking meat, because otherwise the temperature might be high enough for the fat to drip. The fire-pot is placed outside at the back of the concrete house, where the fire can be easily replenished and controlled.

The concrete smoke-house is not only burglar-proof to a greater extent than are wooden structures, but it is fire-proof.

The Senators' Subway

DID you know that the senators at Washington have their own electric subway to take them from the Senate Office Building to the Capitol?

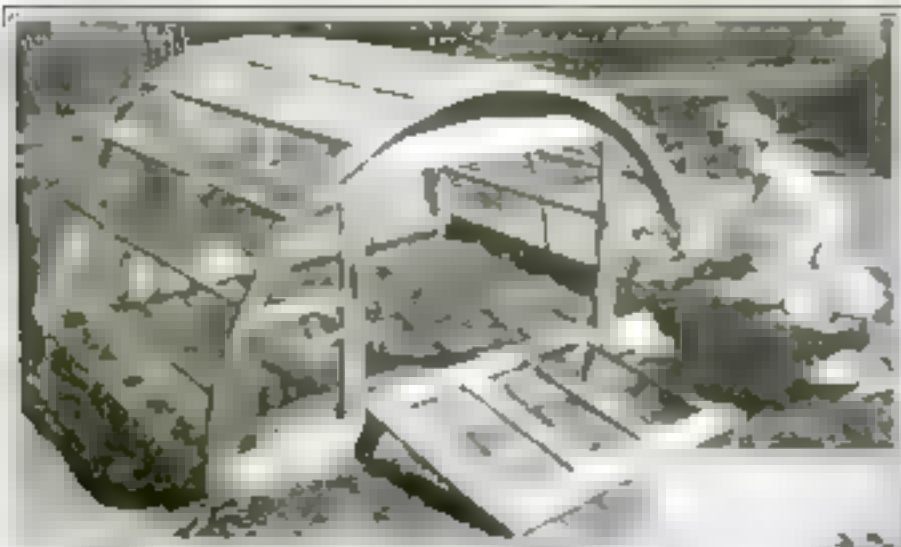
The subway train looks very much like the scenic railway trains you see at amusement parks. But of course the senators don't need to be strapped in. The front end of the train is shown, and in the front seat are Senators Poindexter and Dial.



Woman can do anything a man can, it has been said. Here is exhibit A for feminine efficiency—Miss Bates and her truck

We often hear of "senatorial courtesy" perhaps it thrives because senators have a subway where strap-hanging is not necessary

© International Film Service Co.



© Publishers Photo Service

A hothouse made out of an old drum upon which motion picture films were dried. Old negatives were between the strips

An Improvised Hothouse

FROM a drying-drum upon which miles of motion picture films have been dried, to become the framework of a hothouse is a big jump of adventure. Perhaps hundreds of feet of film, picturing scenes in which heroes, heroines, and flowers figured, once were spun around the wooden drying-frame.

Now the drying-drum has become a fixture of the outdoor sunshine and serves as a support for a photographer's old negatives from which the gelatine has been washed. Through the glass the sunshine pours upon the young plants, and under its warm rays they thrive just as well as in the usual hothouse.

The Lever Potato-Fork

SAYS the farmer to his helper: "Fork up those potatoes," and the helper picks up his fork.

On the handle, down near the prongs, is a clamp that holds in place a swinging metal rod. When the man starts to dig up the potatoes, he thrusts the rod into the ground, and it acts as a fulcrum for the fork, making his work much easier.

The fork becomes a lever and pressure on one end forces the other end up. Instead of lifting the fork at each stroke, it is necessary for the farmer simply to press down on it.



A metal rod attached to the handle of a potato-fork acts as a fulcrum and turns the fork into a lever



The sun, so noisily welcomed by the cockerels, soon becomes a warm visitor and they crowd under the family umbrella

Umbrellas for Chickens

"HOW outrageous is the glare of sunlight here in the poultry yard!" is probably what all the chickens are talking about in their peculiar manner when the midday sun heats fiercely down.

Mr. L. S. Fisher has solved their problem to the complete satisfaction of his valuable chickens. The family umbrella, firmly secured so that a sudden gust cannot whisk it away, was promptly appreciated by the crowd of White Leghorns that flocked under it for shelter. The glorious sun which they had so noisily heralded in the early morning was now screened from sight.

Weeding Made Easy

WHEN the weeds grow up overnight there is a way to eliminate them promptly in the morning. Mr. Lewis Inman has invented a simple arrangement for bringing genuine disaster to the bolshavik weeds that spring up in the garden's orderly plot. He merely shoves a handle somewhat like that on a lawnmower, and a wheel guides some knives over the ground, digging under the weeds with blades that are rounded so they can be worked close to the roots of plants not to be dislodged. The hand-weeder can be piloted around rocks without injury to the knives.



The rounded points of these blades can pass near the roots of plants without any danger of cutting them



A stake with an adjustable wire hoop on it will support a weak-kneed plant. As it grows slide the hoop up or down

Provide Crutches for Weak Tomato Plants

TOMATO plants cannot stand on their own roots, and this is also true of many other plants. They have to be artificially supported throughout their lives. Such plants are usually tied to upright stakes. Yet as they grow taller they must continually be retied.

A plant-supporter has recently been invented, consisting of a wire hoop that slides up and down on a stake. The hoops come in all sizes.

Echoes from the Bottom of the Sea

SOUND travels through still air of a certain density at the rate of about 1,100 feet a second.

Making use of this principle, a device has been tried that promises success in finding the depth of the sea-bottom in any locality. A small amount of explosive material is discharged at the side of a vessel, and the reflected sound from the sea-bottom is caught in a microphone suitably attached to the vessel. A chronograph registers the difference in time between the discharge of the explosive and the reception of the echo in the microphone.

An accuracy within 1-1,500 of a second or about 40 inches in measurement is attainable.



The flag-pole, held in the metal bracket, is adjusted at the desired angle then the clamp is tightened to hold it in place

Taking the Strain Off the Flag-Pole

HANGING out the flag and drawing it in again puts a certain strain upon the staunch flag-pole and the support that holds it in a fixed position. The sudden jerk caused by a gust of wind throws additional weight upon the bracket that holds the pole, and unless it is strong there is an added danger of its breaking.

To overcome these inconvenient possibilities, a new flag-pole bracket has been invented. Mr. Edward S. Mowry is the inventor who had the foresight to design a support for the flag-pole, enabling it to be rigidly clamped in the desired position. The strength of the metal will hold against the tug-of-war set up by the wind. Literally with clenched teeth, it will bravely support the flag.

The method of fastening the cleat to the metal of the bracket gives great security to the strength of the cleat in resisting the pressure of the wind. Heavy flags can be managed easily when they are pulled in or raised on the flagstaff.

Chop Cabbage in Circles

IF you sharpen the edge of your biscuit-cutter you can use it as a chopping-knife. According to the rules of geometry, its circular edge will cut more than three times as much as would a straight blade having the length of its diameter.

Behold the busy housewife below, chopping cabbage. See how much she clips at a single stroke. She finds the circular cutter very easy to handle. Henceforward her family will be fed coleslaw often and in large quantities.



A circular chopping-knife will cut three times as much cabbage as a straight one



Johnny doesn't mind having his hair cut when he sits on a merry go-round hobby-horse

The Barber's Hobby-Horse

"JOHNNY got a hair-cut!" All the hoodlums in the neighborhood yell this after Johnny every time he comes from the barber's. No wonder he weeps when his mother drags him there.

But in one of New York's large department-stores the barbers have no trouble. All the little Johnnies are eager to be shorn. Why? Because the usual stiff-backed barber's chair has disappeared, and in its place there is a regular merry-go-round hobby-horse.

While the barber clips, Johnny pulls the reins and is thoroughly happy.

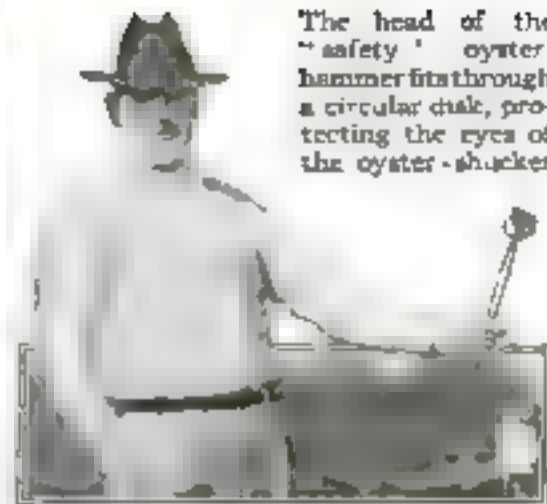
Where the High Cost of Baby-Carriages Doesn't Trouble

WHEN an American mother goes marketing she puts her baby in a rubber-tired carriage, wraps him up in blue ribbons and lace, and starts out, proudly wheeling him before her. But when a Moro mother goes marketing with her children she's not so fussy. She sits her children on her shoulders and lets them hang on to her hair. Thus her hands are free to carry bundles, if necessary.

Such a mother is shown below—though she isn't carrying anything except her children on this trip. She took her husband along to carry the bundles.



The Moro mother carries her children on her shoulders and they clutch her hair



The head of the "safety" oyster hammer fits through a circular disk, protecting the eyes of the oyster-shucker

Protect Your Eyes When Shucking Oysters

"LOOK out for the splinters!" a stranger would exclaim if he gave expression to his thoughts when he sees an "oyster-shucker" professional in the act of hammering open oyster-shells. The bits of flying shell sometimes dart in the direction of the worker's eyes, and there is danger of losing one's sight if a well directed blow sends back a sharp bit.

Mr. Norbert Bures, of Louisiana, has greatly lessened this possibility in the invention of a "safety" oyster-hammer. Attached in a slot back of the hammer's head, and covering the area from which the splinters fly, is a circular disk of transparent material. Celluloid or mica are able to withstand the shock and yet permit the one who hammers the shells to see how to direct his blows. When the workman is very proficient he can strike exactly the right spot without looking at what he is doing, so that even an opaque disk may be used for protection if one desires.

Make Stirring Easy

"STIR constantly," says the recipe. And there has recently been invented a stirrer. It consists of a long metal handle with a flat swinging disk at the end. Suppose you are frying potatoes. A spoon or fork will not scrape them from the bottom of the pan, but the new stirrer will do it thoroughly.

In cooking scrambled eggs, it isn't necessary to scramble them before putting them in the pan. Simply use the stirrer for the job.



A stirrer takes the place of the fork and spoon formerly used for mixing things

Fighting a Fire with Brains

The cub electrician remembers a lesson and saves the power plant

By Charles Magee Adams



Little Bob jerked open the switch, disconnected No. 3, and jumped to fight the fire

OVERHEAD an arriving flash of lightning crackled sharply across the horn-gap arresters. But down on the floor of the power-house, in front of No. 3 unit's panel in the main switchboard, little Bob Fitzgerald, the chief engineer, continued to frown up at his new attendant.

"Np, no," he protested impatiently. "Think! What's the field circuit for, anyhow?"

Johnny Gibson pondered a moment. "Why, it's to excite the alternator," he replied.

Outside, thunder, in the wake of the first lightning flash, rumbled away in the distance, and overhead a second flash crackled more sharply across the horn-gaps. But little Bob continued to frown up at his green assistant.

"Then what do you suppose happens when you open and close this?" he demanded, jabbing a thumb toward a piece of equipment on the slate panel before him.

It was the field switch, and Johnny eyed its heavy polished blades and considered.

"Why, I reckon if you'd open it that'd kill the alternator," he decided at length. "'Cause then there wouldn't be any field."

The thunder boomed closer as little Bob nodded jerkily.

"Of course," he retorted. "When any alternator's running, it's live as long as this switch's closed and dead as long as it's open. Remember that now, and don't go—"

Then the Big Crash Came

A crash drowned out his words. Overhead, in the row of horn-gaps, a huge ball of fire leaped out, blazed for a moment in blinding brilliance, and then broke into a score of crackling streamers.

Little Bob turned quickly toward the switchboard. But scarcely had he done so when, from behind the bulk of unit No. 3, appeared the tall figure of Mike Collins, the oiler, his long arms waving excitedly.

"Fire! Fire!" he yelled. "Number three's a-fire!"

And No. 3 was,

As little Bob, followed by Johnny Gibson, rounded the smoothly swaying Corliss engine and came upon the big generator, a dense cloud of heavy black smoke was pouring out of the pit beneath it, and through this could be seen

the flicker of flame.

"Get some extinguishers!" little Bob commanded.

Mike obeyed. The chief turned and raced back around the engine; and Johnny, thinking he too was in search of extinguishers, followed. But little Bob simply jerked open the big oil switch, disconnected No. 3 from the bus-bars, and dashed back once more.

"Want me to shut her down?" Johnny called.

Little Bob shook his head.

"No! Her breeze'll drive the blaze away from her coils. Come on!"

Chemical Extinguishers to the Rescue

Mike had hurriedly assembled a half dozen chemical extinguishers, ready for use. But the fire likewise had been taking steps in the way of preparedness, and even more rapidly.

In the pit under the generator was a large quantity of oil, accumulated there because of disabled overflow equipment. This had rotted the insulation on the three main leads where they emerged from the stator frame, and the lightning had of course flashed across this weakened spot. Now, as the three men turned the streams of liquid into the smoke cloud, it lifted, disclosing a flare of arc sputtering from one cable to another and igniting both oil and insulation.

"Hurry! Hurry!" little Bob yelled excitedly. "Stop it before it spreads!"

Mike and Johnny obeyed. In spite of the choking gas that rose the instant the liquid came in contact with the heat, they sent their streams hissing into the blaze.

The blazing oil was extinguished. The smoking insulation was extinguished. The spitting tongue of arc was snuffed out—but only as long as the streams were held directly upon it.

"What's the matter with these extinguishers?" little Bob demanded. "Here, give me one!"

But nothing was wrong with the extinguishers. The gas that rose when the liquid struck the heat had the familiar suffocating odor. Yet, as soon as the streams were deflected, the

blazing arc flashed up, driving the line of fire nearer and nearer the stator windings.

The supply of reserve extinguishers at hand was exhausted. "Get some more! Hurry!" little Bob ordered.

Mike handed his still charged tank to the chief, and dashed away.

For another minute the two men who remained fought on side by side in the cloud of gas and smoke. But still the line of fire, led by the crackling arc, crept relentlessly nearer the vitals of the big alternator. Then, while his extinguisher still threw a steady stream, Johnny Gibson dropped it, turned, and darted out of sight behind the still throbbing unit.

Little Bob was frantic.

"Come back! Come back here!" he shouted. But Johnny had gone.

Left alone, the chief engineer turned against the fire with feverish desperation. The pulsing flicker danced between the cables, closer and closer to the stator windings. And then, suddenly, like a match flame caught in a puff of wind, it disappeared.

What Johnny Had Done

Little Bob deflected his extinguisher stream; but it did not reappear. He shot the liquid at the insulation, and its glow died to charred blackness. He sprayed the flickering oil, and it subsided. A moment later Johnny Gibson slid breathlessly into sight around the big generator.

Little Bob swung on him vehemently.

"Quitter! You quitter!" he snapped. "Do you think you can run off and leave me to put out this fire by myself?"

Johnny stared at him, nonplussed.

"Why, I—I just ran around and killed the generator," he explained.

Little Bob shook a blackened forefinger at him. "I disconnected her myself, the first thing," he retorted.

Johnny nodded.

"Yes," he answered. "But you didn't open the field switch, and that left her live. Don't you remember what you told me a while ago? That's why she kept on arcing. I opened the field switch just now."

For a moment little Bob blinked stupidly. Then a smile of comprehension overspread his smoke-streaked face.

"By gum, Johnny, you win! If you keep on learning like that, I'll be darned if I won't have to hunt a new job!"



Just in Time, He Remembered the Field Switch

Warned by the mutter of the approaching thunder storm, the men in the power house were ready, but when a lightning flash of doom across the wooded mountains on the main ridge gave general notice that a bad storm was on its way, they were not prepared. Near at hand, near at the fireplace, stood the

field switch, and trouble seemed big when Johnny Gibbons, the cub electrician, thought of his latest lesson from the boss. He dropped his extinguisher and ran, but got no farther for a moment when the stormy winded out. Johnny had thrown open the field switch and killed the generator

Feeding Films to the Magic Lantern

A reel of them is much smaller and lighter than glass



This roll of negative
film weighs
less than a
single glass
slide. It is much
smaller and lighter
than a glass slide
and can be used
in the magic lantern.

This roll of negative
film weighs
less than a
single glass
slide. It is much
smaller and lighter
than a glass slide
and can be used
in the magic lantern.



This is a negative
of a scene from
a film. It is much
smaller and lighter
than a glass slide
and can be used
in the magic lantern.



My lecture tonight is on New York City. I have a large number of slides
of the city, but a small number of films that he can easily see in his pocket.



The film is made by M. F. H. White of New York. It is a
film of the city of New York, showing the film's weight of 100
pounds.

Food from Above

Lunch is served on a string
where apartments are high



Willie's lunch is high up. He is a slice of bread with butter. It is coming down on a string.



The baby likes apples and he gets them through one of these big sisters.



This woman has five children. How do we know? Because she is lowering three pieces of food, a pear and two cakes.



Don't bother me! Go out and play. In this fashion the apartment house mother gets rid of her children until her work is done. When Johnny is hungry he comes up for his lunch.

Willie has the bread safely in one hand and the banana safely in the other, and is eating both at once.



This is what Mrs. Murphy saw when she looked out of her window. Mrs. O'Brien on the floor below was lowering an apple to her step-



Baby soon gets used to looking up at the window for his lunch. He knows that if he is not looking up something will appear at the window and then start down. He reaches up and the bottle is in his hand.



She smears her face with white paste that she kneads on a stone

What a Pasty Face!

FACE powder isn't effective enough to give the Marua woman that white-washed look she admires so much in her pale-faced sisters. Her natural hue being a rich, dark brown, powder simply turns it yellow. The Marua tribe lives in South Africa.

But the brown can't possibly show through a coating of white paste such as clowns use. And thus we find her kneeling before a stone as she kneads her daily paste. She smears it over her face and ears, but does not touch her mouth.

Where Directories Hang on Corner Posts

DID you ever go from house to house, trying to find out where John Smith lived? And when he lives in a small town he is more careless than ever about giving you the name of his street and his number.

But in a Western city the improvement club has hung directories on many of the guide-posts throughout the town. When you want Smith, you look him up under "S" in the directory. There you find Smith's street and number. You need only find out where the street is and then you can find your way to his house.

Whether you be friend, foe, mailman, or bill collector, you will find the corner directory a great help. Suburbs throughout the country will undoubtedly follow suit.



In a Western suburb directories are hung at many of the corners



These witnesses of a traffic accident are demonstrating just how it happened

How Did It Happen?

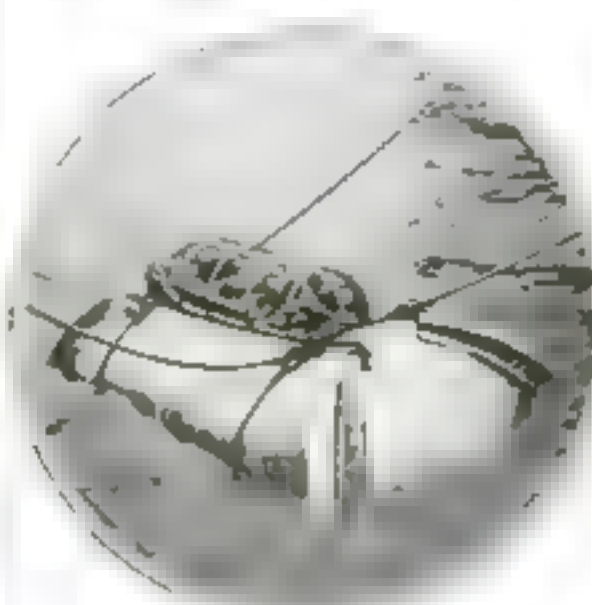
CRASH! The limousine ran into the truck—or did the truck run into the limousine? Accidents happen so unexpectedly that it is often hard to tell who is to blame.

In the traffic court at Washington, witnesses of traffic accidents do not have to tell what they saw—they demonstrate it on a small cardboard street corner. There are models of all sorts of vehicles, and each witness plays a sort of chess with them—putting them in their proper places.

Jewels First!

GOLD and precious stones—billions of dollars' worth—have gone down with wrecked ships for centuries. The bottom of the sea is inestimably wealthy. But its income is destined to drop off now, for there has been invented a floating safe. You put your valuables in it when you board the ship.

The safe, of course, is kept on deck. When a ship goes down, the safe breaks loose and floats. Automatically a red light flares from the top of the safe and a siren horn blows. The life-boats cluster around it, and, if all is well, a passing ship will see the flare and come to the rescue.



Valuables are safe, even in shipwreck, in this floating receptacle



The office pet wouldn't stop nibbling, so they bought him a muzzle

Bunny Wears a Muzzle

PETER RABBIT loved to nibble—that's what got him in trouble—and so do all of Peter's brothers and sisters. One little brother is shown above effectively muzzled. He is the pet of a large London office, and he walks all over everyone. But, unfortunately, he nibbles.

He nibbled the ruffles off a woman clerk's waist, and he chewed the book-keeper's trousers. And so the chief bought him a muzzle, and he wears it in business hours. This Peter Rabbit seems to like office life.

They're Keeping Cool on a Warm Job

WHEN fire and sunshine enter into a combination, even the upper region where telephone cables are suspended may become a warm place. At least, that is what several repairmen thought who hurried out to the scene of damage to fix some cables burned by a near-by fire.

The sun from above and the warm air from the scene of the fire below together made the work difficult. The protection afforded by umbrellas seemed attractive to some of the men, and as there was not enough of a breeze to make it impossible to keep the umbrellas in position, several of them kept cool by thus screening off the sun.



These wiremen fastened umbrellas to the wires to screen off the sun



His master lost both legs in the war, so Paulo pulls him around town

This French Hero's Dog is His Motor

PAULO, the dog, and M. Andrivet, his master, both were wounded in the Argonne. Paulo recovered, but his master lost both legs. They have both returned to Paris, and may be seen any day going through the streets together. M. Andrivet sits in a tricycle while Paulo runs alongside and acts as a motor. He uses a chain drive.

The tricycle is equipped with a steering wheel that enables the cripple man to guide. Here you see the two on a main street riding beside a trolley car. Paulo is an excellent motor, and he never stails.

Your Special Hook

NURSES, cooks, maids, and housekeepers are often known to mix things up—towels, for instance. How can you be sure that your towel hasn't changed places with somebody else's? By using an individual towel clip like those below.

When you wish to take your towel out or put it in, you simply press a button and the jaws of the clip will open. There is a tooth-brush holder connected with each clip. The clips may be labeled.



Individual towel clips with tooth-brush holders attached will help keep your family well



The "safety first" window-apron for protecting window washers

For Betty When She Washes the Windows

TO prevent youngsters and others from tumbling out of upper-story windows, a safety-apron supported from rods mounted in brackets at the side of the window has been invented by P. B. Blankennagel, of Passaic, N. J. The window-apron is supported at an outwardly inclined angle that obstructs little of the light and air.

Washing the windows can be done more safely with the device in place to prevent the industrious window-washer from falling out backward. The rods can be easily released from the sockets to which they are secured, and the device removed when not needed.



This gorilla, "John," is acting as valet, lacing up a pair of shoes

This Gorilla Has Solved the Servant Problem

VISIT the home of Madame Alyce, in London, and you will see a clever gorilla whose name is John. It is reputed to be the most intelligent gorilla in England, and is a past master in the art of acting as valet or maid. Since the animal is so adept in training, perhaps gorillas will be taught to be substitutes for "hired" men.

No Mistakes Here

AN automatic score-board, so arranged that only the right score for each player can be registered, and no mistakes can be made is an invention of Mr. Frank A. Garbutt, vice-president of the Los Angeles Athletic Club.

The size of the score-board is four by five feet. The names of the two players appear on a sliding blackboard, which can be removed and replaced in a moment. On the lower blackboard is the score under their games. At the top is the indicator that shows who is "in."

Now, here is the special feature of the device which will appeal to all ball-players. When the cord is pulled that shows the player's score on the indicator at the top above the blackboard, a mistake cannot be made giving the score to the wrong player, because the indicator "in" when moved to one side automatically locks the other.



An ingenious score-board which prevents a score-keeper from pulling the wrong cord and registering the score to the wrong player



Scrape the food off your pots and pans with this many-sided scraper

Scraping the Pan

WATER won't always wash off the food that clings to pots and pans. They must be scraped. And now there is a scraper of many sides that will do the scraping. The sides are of different lengths, and there is a dent in the center of the scraper that enables you to grasp it firmly.

Near the shortest side there is a hole by means of which you hang it on the wall.

Sermons by Telephone

A FALLING rock in a mine in Wales hit Sam Pritchard, a miner, and injured him so severely that he thought it would be a long time before he could hear the sermons preached in his local Baptist church. But three friends determined that he should hear the Sunday service though he was unable to go to the church.

They set about rigging up a telephone for his benefit. Now he can lie in bed with the receivers at his ears and hear every word of the sermon. The chapel is some distance away, but the words of the preacher come as clearly by telephone as they would be heard in the building.



An edible gourd called a bean. It is not as nutritive as an ordinary bean, but its bulk makes up for other deficiencies

When a Bean Is Not a Bean It's a Gourd

ONE so-called New Guinea butter-bean will provide a meal for a whole family. If the diner does not object to the slightly bitter taste, he may be satisfied with his dish, it is indeed a cheap one, for the seeds of this curious vegetable sell six for fifty cents. But the remarkable fact must be announced that the so-called bean is not a bean at all—it is a gourd!

Advertised extensively as a giant member of the heavy tribe, this gourd springs up as by magic when the seeds are planted after the danger of frost has passed. Like the ordinary pole-bean, it will grow whether cared for or not. In food value it compares with the summer squash, and by no means has the nutritive value of true beans.

Drop a few seeds of this remarkable bean, and almost overnight, like Jack's "bean-stalk," the great gourd will spring up. It is an interesting addition to the garden, and well worth the sum spent for it.



An ordinary lamp wick, soaked in grease, will keep the pan in condition

Greasing the Griddle

"BUCKWHEAT cakes—put 'em on the griddle," sings the negro comedian. But first you must grease the griddle. How? Take a piece of lamp-wick, soak it in grease, and clamp it in a wire frame. It will distribute the grease evenly and may be used for a long time before the wick need be changed. If you would have plenty of griddle cakes, make one of these greasers for your cook.

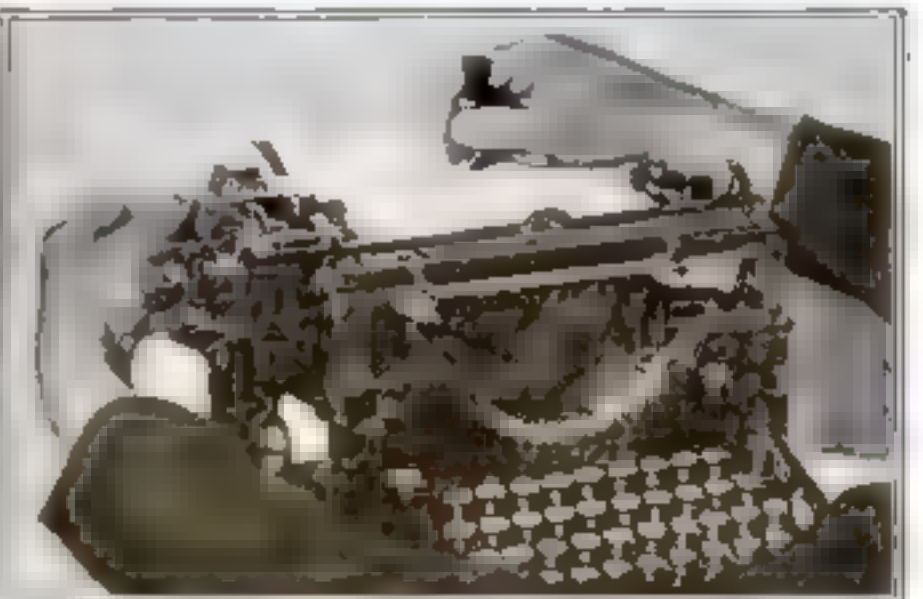
To Correct Typewriting

STENOGRAPHERS know what a tough job it is to make erasures on a typewriter when carbon copies are being made. A card slipped between the carbon and the under sheet of paper may work sometimes, but often it causes a smear.

Here is an arrangement for eliminating the smear. A padded flat bar is attached across the typewriter just at the place to permit the sheet requiring erasures to rest over the pad. It is adjustable and can be removed easily when not needed. The carbon sheet passes under the bar-pad while the sheet upon which the erasure is made passes across the upper face of the pad.



Not many people can lie abed Sunday morning and hear the sermon at the same time!



The paper rests upon a pad; the carbon paper passes below the bar and does not smear the copy.



As the airplane speeds across the ground, pebbles, mud, and bits of twig fly upward. The mud-guards protect the propeller.

After lifting and moving a load to its destination, the truck elevates the load to the shelf upon which it is to be stored.

Mud-Guards in the Air

ONE would scarcely imagine that airplanes need fenders to keep misty clouds from splashing into the fuselage, and they don't. But they do have mud-guards to keep the mud of flying-fields from splattering all over their perfectly good propellers that are whirling at a couple of thousand revolutions a minute.

These little gobs of mud, bits of twigs, and pebbles hit the whirling piece of valuable timber a terrific blow—at the rate of five hundred miles an hour, in fact, for this is the peripheral speed of a modern air-screw. Every propeller is carefully balanced. A bit of wood will set up a tremendous strain on the crank-shaft of the engine, and the bearings. Hence airplane wheels now have mud-guards.

An Electric Hair-Cut

A SMALL electric motor operating an arrangement of suitable cutting blades, the electric hair-cutter is the invention of a Berlin barber. Instead of laboriously working a pair of scissors all day in the art of cutting hair, the electric machine needs only a few minutes of power to do the work of a pair of scissors. Rheostats regulate the current—the requirements of the motor and enable the barber to work the cutter at the desired speed.

Electric hair-cutting, clipping, massage, shampoo, and sops lighten the barber's work.

How the Natives Carry Water in Old Siam

"WATER-BOTTLES made of animal skins? Why?" one might ask.

Within twenty degrees of the equator on the Indo-Chinese peninsula, the little country Muang Thai, as its inhabitants know it—Siam, as the rest of the world recognizes it—basks in the tropical sun. Its lofty mountain-peaks rise above the mists, clear-cut against the sky. Forests of teak, fields of rice, and endless dense jungles of blowing palms confront the visitor in this strangely beautiful country.

Here, in the various steps of climate encountered from the tropical coast-line to the temperate region of upper altitudes, one finds the people doing their work in the most primitive ways. Where water must be carried, instead of conveying it in pipes by a system of pumps, the natives simply carry it by hand.

In order to carry the water exactly as their forefathers did centuries ago, the Siamese have made water-tight bags out of animal skins. The bags are light when empty and easily carried when filled.



The Siamese carry water in bags made of animal skins, just as their ancestors did.

Store It by Truck.

A MOTOR-TRUCK run by storage batteries saves a lot of time and labor in its useful service in storage-houses, warehouses, laundries, and freight depots. It picks up boxes and kegs and conveys them to the place that has been designated for them.

But that is not all. It elevates the load until it reaches the height of the shelf or the freight-car level where it is to be placed.

The driving power is separate from the lifting mechanism, this being controlled by a small motor on top of the truck, which will lift a 4,000-pound load to a height of seventy-six inches. It is said that by its use store-room capacity can be increased from 200 to 500 per cent.

Electrify Your Brush

HARROWING tangles will make your hair stand on end, and so will the new electric brush shown below. In fact, it will even make your hair curl. The brush has metal bristles, and on its back it carries a small box inside of which is a magnet. To operate it you simply work a convenient handle.

The brush was intended originally for massaging the scalp. But new uses are being found for it daily. For instance, it may also be used for massaging the face—not directly but by means of a massage attachment that can be applied.



What makes his hair curl? The electric brush he is using.



This boy is having his hair cut by a new electric machine.

The Gas-Holder—a City Reservoir

THE gas-holder is to the city that uses artificial gas what the reservoir is to a city's water supply.

The water used by a city is not forced directly into the city's distributing mains, but is pumped from its source of supply into reservoirs and stored until it is used. Water reservoirs are always located on hills, so that the water may flow downward, seeking its level in the mains. It is thereby distributed to the consumer under a normal pressure.

The gas-holder fulfills these requirements in supplying gas. Instead of being located on a hill, it is placed whenever possible at the lowest point in the distribution system, so that the gas flowing out of it, owing to its being lighter than air, will rise of its own accord to the points at which it is consumed.

The weight of the holder containing the gas supplies it with the necessary pressure to overcome the friction caused by the gas flowing through the mains, and thus it reaches the consumer with pressure sufficient to meet the demand. Were it not that the holder supplies this energy as well as the gas itself, the gas could not flow continuously through the mains to the consumer.

It may surprise some people to learn that the total floating weight of the holder—that weight which the gas is compelled to lift—is more than twelve hundred tons. This weight presses down on the gas contained in the holder to the extent of a little less than half a pound to the square inch.

The gas is not allowed to enter the distributing mains under this pressure, however. It is reduced or throttled back by governors at the works, giving the consumer about one tenth of a pound to the square inch.

Three elements make up the holder: first, the tank, resting on its concrete foundation and containing sixteen million gallons of water; then the guide framing, secured to the outside of the tank to guide the holder in its movements up and down as gas is let

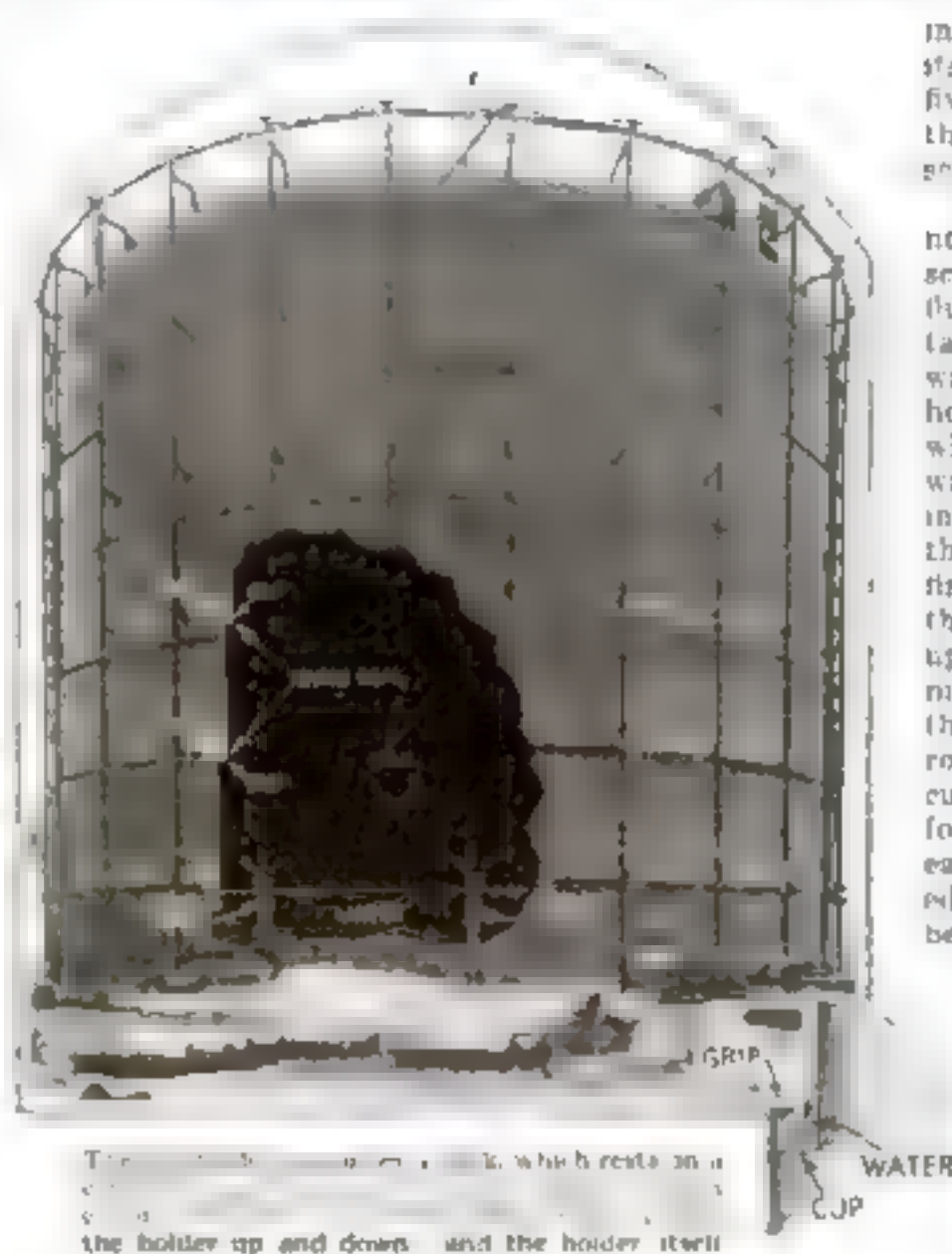
in or out; then the holder itself, which is made up of five sections, folding up in the holder tank like a telescope.

When the holder contains no gas, all five sections telescope in the tank and are flush with the top of the tank, which is filled with water. As gas is let into the holder through the inlet pipe which passes up through the water in the tank, the first or inner section, which carries the roof or crown, is inflated; and when it reaches the top of the tank it picks up the second section by means of what is known as the cup. This cup runs round the whole outside circumference of the holder, forming the bottom edge of each section, just as if the edges were turned over and bent upward to hold water.

As each section rises it picks up the grip or inverted cup of the next section, and as each cup is filled with water, there is formed what is known as the water lute, or seal, to prevent the gas from escaping.

When the holder is fully inflated all the sections are lifted with their respective cups filled with water and the lowest edge of the lowest section is about thirteen inches below the surface of the water in the tank. This prevents the gas from escaping at the bottom.

A gas-holder is the most expensive single piece of equipment that a gas company is called upon to provide; yet, in spite of this, from the standpoint of economical operation it is the cheapest.



The gas holder, which rests on a concrete foundation, and the holder itself.

Deadening Noise with Cotton

INSTEAD of putting cotton plugs in the ears to stop the noise of the metal gear in machinery where rasping noise is not wanted, the cotton has been put to use in making the gear itself noiseless. After trying many kinds of materials, metallic and non-metallic, the choice was narrowed down to the use of steel or compressed cotton. The steel gear was found to make such a nerve-racking noise that it was impossible, so the cotton gear was tried.

Thus the fabroil gear was developed. It was at first designed to work noiselessly in the average gear-train. Specially selected cotton is wound around a drum, capped and bottomed

with steel shrouds of the required size. Then the whole is put into a hydraulic press and brought to the proper dimensions.

The resulting gear wears as well as cast-iron, and produces no noise when used in connection with metallic parts. Its elasticity gives it a closer surface contact, and is not affected by steam, hot water, or any condition that would injure iron gears.

Cotton gears may be used in automobile engines, printing-presses and other machines.

Gear wheels made of compressed cotton to deaden the noise in the gear train—the series of interlocking wheels attached to automobile engines, printing presses and other machines.



What Makes a Baseball Curve?

It is simply a matter of atmospheric pressure

By Lindley Pyle

HOLD up a sheet of paper and blow vigorously between the two separated ends. The leaves of paper move toward each other and cling together. Obviously, the moving stream of air exerts a suction effect upon adjacent bodies. In more precise language, the atmospheric pressure between the paper leaves is lowered by the air velocity action, and the unaltered pressure of the air on the outside crushes the paper leaves together.

Blow through a distended envelope that has been sealed and that has had its ends slit open. The side walls collapse and the envelope flattens, crushed by the greater pressure of the still air outside the envelope.

Suspend a cork from a silk thread, and with a "straw," such as those used at soda-fountains, blow a stream of air past the cork at a distance therefrom of at least three fourths of an inch. The air pressure on the breeze side of the cork is reduced, and the normal atmospheric pressure on the quiet side of the cork pushes the cork over and into the stream of air.

Not a New Discovery

Similar experiments may be performed with water as the fluid medium instead of air, using a submerged hose to furnish a high-velocity water current. Let the nozzle of a hose delivering a quarter-inch stream of water at high pressure be thrust under the surface of a body of water, and let the stream pass between the submerged hands, held with the palms an inch apart. Marked suction will be felt and sensible effort will be required to keep the palms apart.

Examples might be multiplied demonstrating that, where a portion of a fluid is moving faster than an adjacent part, the pressure in the higher-velocity region is less than in the lower-velocity region. This is not a new discovery in science; it has been known for nearly two hundred years. Nevertheless, it is of interest to all of us, since by this principle we may explain the curve of a baseball.

Tie one end of a six-foot length of string to a tennis-ball, and fasten the other end to the ceiling of a room free from air currents. Spin the ball for several minutes in one direction so as to twist the string, then

allow the string to untwist, thus putting the ball into a high rate of rotation. The air close to the ball is

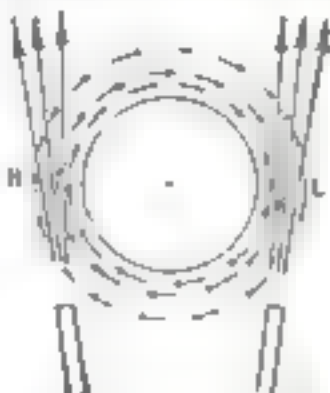


Fig. 1. Short arrows indicate the air rotating with the ball; long arrows, the air from two straws.



soda "straws" in your mouth and blow a stream of air past each side of the ball.

In the diagram Fig. 1 the short arrows indicate the swirl of air rotating with the ball, while the long arrows

represent the air that streams past the ball from the straws. It is plain that the net effect of the mingling of these air currents is to cut down the velocity effect at *L* (where the two currents are in opposite directions) and to maintain it at *H* (where the two currents are in the same direction). The preceding experiments have demonstrated that the air pressure is consequently greater at *L* than at *H*, and one is not surprised to see the ball pushed over toward *H*.

As soon as he stops blowing the sheets of paper will come together and cling. Why? Because the atmospheric pressure between them has been lowered by the blowing and it is overcome by the steady pressure from without.

Discard the straws, and produce a breeze past the spinning ball by swinging it to and

fro like a pendulum. The effect upon the spinning ball as it moves bodily through the air is the same as when the breeze past it is produced by blowing. In the diagram Fig. 2, when the spinning ball is pulled aside (by its string) to *a* and then swung toward *b*, it corresponds precisely to the case just described, except that the breeze past the ball is due to the bodily motion of the ball through the air. Instead of reaching *b* the side thrust on the ball carries it to *c*. On the return trip it goes to *d*, and on the next swing to *a*. If the direction of spin be reversed the plane of the pendular vibration rotates in the opposite direction.

The Ball "Follows Its Nose"

The front of the moving ball is often termed its "nose." It will be noted that the path of the moving ball deviates in such a direction as to lead one to say that the ball "follows its nose."

The experiments have led directly to the case of the curving baseball. The delivery of the pitcher is such that the ball leaves his hand with a rapid spin, and the ball follows its nose, whether it be in-shoot, drop, or what not—for a reason amply illustrated by the foregoing simple experiments.



Blow through a straw at a suspended cork; the pressure of outside air forces the cork into the stream of air.

If you spin the ends of a closed envelope and blow through it the result will be the same as in the case of the paper.



Fig. 2. The curve of a baseball, following the principle of air currents indicated in Fig. 1 above.

dragged into motion along with the surface of the ball, as may be seen by bringing the smoke of a cigarette into close proximity. Now, while the ball is spinning (not swinging), place two

Laying Concrete Under Difficulties

LAYING a concrete pavement in a narrow alley lined with irregular rows of fences and telegraph-poles is the feat performed by the city of St. Louis. The fifteen-foot alley was so narrow that teams couldn't turn around in it, so all of the materials had to be delivered and spread upon the sub-grade before the actual concreting began.

Because of the irregular line of sheds, fences, and poles a difficulty had to be met in the placing of suitable forms along the sides of the alleys. Iron-bar guides were used to overcome this difficulty, the

long, and were set in sufficient numbers to avoid the interference of the projections along the sides, which in some cases varied as much as six inches. The irons were driven to grade along a line set between the stakes, the center of the alley to be four inches lower than the sides. Then came the difficult job of laying the concrete in so cramped a space.

The lower course was deposited within the reach of the ordinary boom-and-bucket mixer, a space of about fifteen feet. To grade it properly it was tamped lightly and then covered with the top mixture, which



The slanting end wall of the tank permits the fowl to escape from its sudden bath.

An Unexpected Plunge for the Poultry

MUCH time and labor can be consumed when it is necessary to dip poultry conforming to the rules of the poultry-yard hygiene. Imagine the task of separately immersing two or three hundred fowls!

Mr. Alva F. Randolph comes forward with an ingenious patent by which the members of the feathered community can be given a highly effective plunge-bath in whatever liquid may be required. From a compartment the chickens walk across a tilting bridge, and, one at a time, are gently let down into the liquid.

The apparatus works automatically. As the fowl steps past the central pivot of the bridge the platform tilts downward, and the surprised chicken finds itself being immersed. A slanting gangway formed by the end of the tank permits the dipped fowl to walk out and dry itself. As the bridge tilts down, a plank slides across the opening at the other end to prevent the other chickens from coming on the bridge too soon.



Here we see a template being moved across the wet concrete, sliding upon iron guide-bars at the side. The bars are six feet long.

Building Trees for Birds

WOULD you have wrens, flickers, owls, or bluebirds, or would you like a few of each in your garden? There is a certain way to get the very birds you want, and that is to make a tree for them. Dr. B. Harry Warren, of West Chester, Pa., makes imitation trees to attract birds. He makes them of cement, cork-bark, and other suitable material, and just at the place where a wren, an owl, a flicker, or a woodpecker would look for the desirable location of a nest, a cavity is made ready for the home-building birds.

In the tip of each stump-like limb of the concrete tree there is a hole leading to a nest cavity of exactly the right size to accommodate the bird desired. The hole for the wren is one inch in diameter, and the nest cavity is in a piece of drain-tile.

Four nests are arranged for in this tree—three in the limbs and one in the trunk and it is expected that, besides the house wren, a bluebird, a flicker, and perhaps one of the smaller woodpeckers (such as the downy woodpecker) will find free lodging in the tree.

was struck off with a tamplet sliding upon the iron side-guides. The bars were then drawn out and the space filled with wet mortar. Planks laid on top of the concrete on both sides of the alley served as a platform for the roller-man and the finishers.

For a narrow alley where there is not enough room for a team to turn around, the problem of laying a concrete pavement calls for such ingenuity as has been displayed in this case. The number of protruding sheds and irregular fences, punctuated by the intruding line of telegraph-poles, would have hindered a less resourceful effort at spreading the cement floor.



Making a concrete tree. In the limbs and in the trunk are openings leading to nest cavities for several birds.

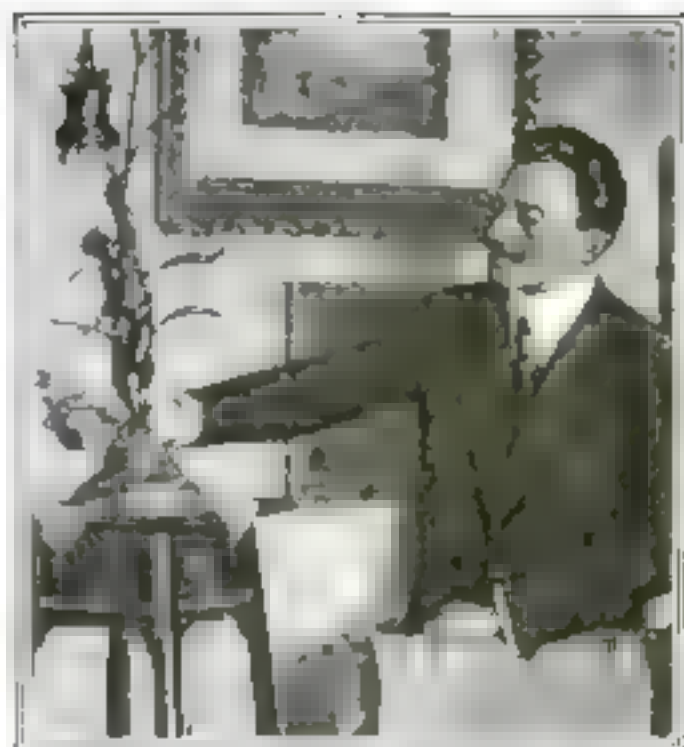
Making Gas Connections Fool-Proof

EVEN a child may safely be intrusted with switching the current of an electric light on or off. If you have a contact socket in the wall of your room, you only need a long enough insulated double wire with a contact plug to utilize the electric current for your reading- or piano-lamp, your toaster, your curling-tongs, or your electric iron. Even permanent gas fixtures are by many persons considered less desirable, because there is always the possibility of accident through gas escaping from a stop-cock carelessly or accidentally opened. With temporary connections, by means of gas tubes, the danger is even greater.

Many of the objectionable features of temporary gas connections, however, are eliminated by a new contact plug. The socket is attached to the end of a service pipe, and is set in the wall flush with the surface. Connection with a reading-lamp, gas-heater, or any other appliance is made by means of a gas-tight and flexible metal tube, the con-

necting plug of which is inserted in the wall socket and fastened by a quarter turn of the plug. Turning the plug in the socket not only securely fastens the flexible tube, but at the same time turns on the gas. If the plug is accidentally removed from the socket, the gas is automatically shut off.

In the daytime, when the gas connection is not needed, the plug of the connecting tube is removed from the socket, which, being set in a brass plate and flush with the wall, is neither conspicuous nor unsightly. The same socket may be used at different times for connections with various fixtures, such as piano- or reading-lamps, heaters, toasters, percolators, or chafing-disks. The same metal tube may be used for all of these fixtures, or, still better, each may be supplied with its own tube of appropriate length, which is left attached to the fixture.



Push the plug in the socket, give it a quarter turn, and the gas from the service pipe will flow to your lamp or heater.

An Airplane that Really "Hops Off"

IN order to enable an airplane to hop off without the necessity of running along the ground, Earl Atkinson has invented a novel launching device. The engine pumps compressed air into a tank carried within the fuselage, and a connection with this tank extends to

two cylinders fixed beneath the wings of the machine. The airplane rests upon these metal legs until it is ready to start. When compressed air is admitted into the cylinders, the legs are thrust out in such a manner that the machine laterally bounds upward and is wafted away under

Here is an invention that the inventor claims will enable an airplane to "hop off" like a giant bird.



the power of its own propellers.

The airplane can be given a free standing start by the impulsive compressed air charge. Means that normally shut off communication between the air-reservoir and the hollow "leg" are adapted to open automatically just when the airplane, under the increasing thrust of its propeller, is lifted to clear its landing-gear from the ground. We should like to see the propellers work before we commit ourselves on the subject of practicability.

How to Demagnetize a Watch

REMEMBER the last time you were near an electric motor and afterward your watch wouldn't go? You took it to the watchmaker and he said it was mag-

netized and it would have to be demagnetized—one dollar, please!

The accompanying illustration shows what a simple operation it is to demagnetize a watch. It is tied to a piece of string or ribbon, twisted so that it spins around when released, and then, while it is spinning rapidly, it is passed through a coil of wire carrying an alternating current. The operation takes about half a minute.

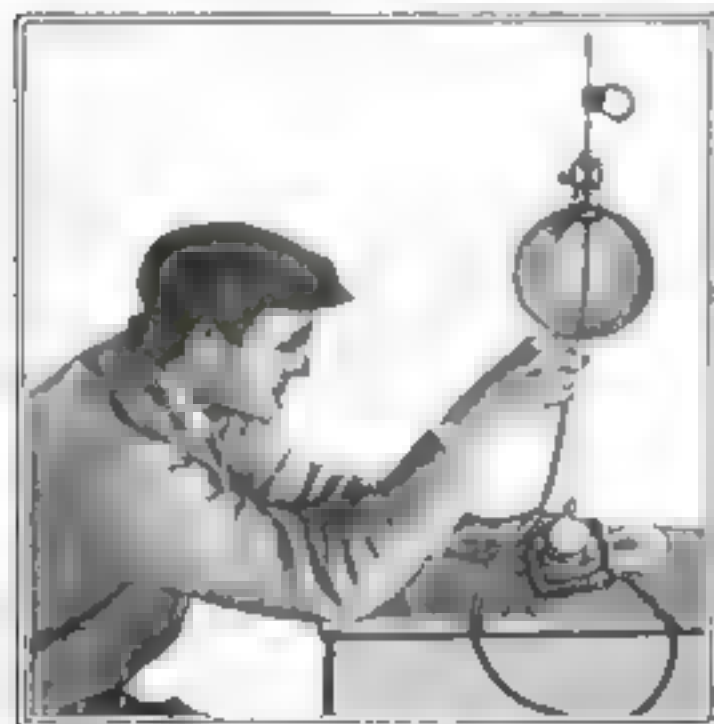
The coil shown in the illustration is wound with 186 turns of insulated copper magnet wire wound in fourteen layers of fourteen turns to the layer. It is supplied with lamp-cord leads, tapped, and shellacked. For operation it is connected directly to the alternating-current supply of 110 volts by removing a lamp and inserting an attachment plug. Great care must be taken to ascertain that the lighting supply is alternating and not direct current, since if the coil is connected to a direct-current supply, the watch will be magnetized more strongly than before.

The Name in the Ceiling

"SENSELESS!" garbles the subway guard. The car is crowded, you can't see the station signs; you can't understand the guard. You don't know where you are. Can this situation be remedied? The London Metropolitan Railroad is trying to remedy it by installing in all the cars electrical station signals. Just after the train leaves one station the name of the next station flashes upon the ceiling.

The ceiling is divided into panels, and there is a station name in each one, placed consecutively. The signal system works automatically. There is a small striker on the track, a short distance beyond each station, that operates a set of switches in the ceiling of the car. The motorman adjusts the switches before he starts out, and the striker does the rest. As one station name disappears the next one shines forth. Everyone can see the ceiling, and thus there need be no confusion every time the train stops.

If station flashing proves successful, perhaps a map will be added to each panel. It is planned to have the map cover the district surrounding each station, and to include the names of the leading stores and theaters.



He is demagnetizing his watch by passing it through an electric coil while he spins it rapidly.

Turn on the Cold and Let's Have Winter

BEFORE we turn on the steam to make artificial spring and summer for the greenhouse, we must turn on the refrigerating system to produce artificial winter.

If we would produce certain plants out of season. Experiments by Dr. Frederick Coville, botanist of the Department of Agriculture, seem to demonstrate that some plant life, such as the blueberry, can thrive only when it has passed through the cycle of climatic changes due to the seasons.

From his experiments the fact was definitely established that when a blueberry plant has com-



In order to chill certain plants to turn their stored starch into sugar for their food, the greenhouse is equipped with a refrigerating system.

pleted its growth in spring and summer and later in the season has gorged its twigs, stems, and roots with starch and other storage foods for early spring use, it becomes dormant and, shedding its leaves, refuses to grow again at the temperatures which in spring and summer would be most favorable to its growth.

But after the plant has been exposed to prolonged chilling it is ready to grow. During the period of chilling there occurs the transformation of stored starch into sugar, which is essential before the plant can use it for food.

Get Off the Wire, Moose!

IT happened in the Maine woods. A lineman was sent out to locate an open wire. He came upon the break, but found that about five hundred feet of the wire had entirely disappeared. He went off to get enough wire to fill the gap, and when he returned he found a large bull moose there.

The moose had returned to the scene of his crime with the wire wrapped around him and a long end trailing behind. He stood there grandly sizing up his enemy and the enemy in the meanwhile stealthily picked up the end of the moose's wire and tied it to a tree. Then he mended the break with the new wire.

When his work was done he turned his attention to the moose, which was still standing around. Armed with a long sapling, he chased the moose around two trees until the wire was so short that the moose tripped over it and fell.



Who stole my wire? asked the lineman. "I did," said the moose (speaking with his eyes). This incident actually happened in the Maine woods.

The lineman came as close as he dared, cut the wire, and then ran for the nearest tree. When he was sitting safely on a branch he looked down at the moose and saw that the animal was still on the ground, panting for breath. The wire was wound tightly around his neck. But in a few minutes he had recovered his wind. He jumped up and trotted off with just a few feet of wire to call his own.

According to the lineman, the moose had a good spread of antlers, but the man didn't think that the short piece of wire wound around them would get the moose into trouble. Yet, a short time before this telephone catastrophe, a moose near Lake Saurdahunk ran around with a piece of wire in his antlers, got caught in the branch of a tree, and died there.

A moose's antlers are powerful and are very useful when he fights, unless they get caught.

The New Tie-Nipper Spikes Rails in Less Time with Fewer Men

ASIMPLE iron tool that is stronger and more rapid than the working power of two men is the new implement employed by a Western street railway. It consists of a lever, a handle, and a head and foot.

Ordinarily the laying of rails requires the use of two men at the rail-end where each man with a steel bar guides the heavy metal while other workmen spike it to the ties. The new arrangement requires only one man. He adjusts the foot of the nipper under the tie, places the head over the bar of the rail, and grasps the



Spiking a rail that is held firmly to the ties by a single man using a tie-nipper. The old method required a man on each side to hold the tie

lever. The tie is then firmly held to the rail while the spiking is done by the laborer.

A test demonstrated that using the new tie-nipper the work of one man could be dispensed with, and that the work could be done in one third the time required by the old method.

The new tool weighs twenty-six pounds when equipped to handle a seven-inch T-rail. The foot of the device is made in various lengths to fit different heights of rails, and is ten inches high from the horizontal base to the pivot in the top bar. The lever is about six feet long.

How to Close All the Windows at Once



In the picture at the left the inventor, Mr. L. M. Phelps, is placing a single drop of water from an eye-dropper upon a strip of blotting paper. As if by magic the drop of water causes the mechanism instantly to start closing the window. The moisture detectors can be made so sensitive that they will close at the first drop of rain.

Presto! The drop of moisture soaked into the blotting-paper strip and the rain-trap is sprung. The spring fastened to the window sash is released, so that it draws down the sash as noiselessly as if it were drawn down by hand. An inside connection with the other windows also brings them down, and the whole house is made window rain-proof.



PUT an automatic window-operator on one of the windows, connect all of the windows suitably on the inside with the "inside sash control," and connect the system with an alarm-clock. At a designated time every one of the windows will be closed. Mr. L. M. Phelps, the inventor, claims that all the windows in the world, if properly connected with his automatic operator and sash control, could be closed simultaneously with the fall of a single drop of moisture upon the sensitive strip operating the "master sash."

The person who goes away leaving the window of his room open need not break an important engagement to rush back at the first drop of rain. The automatic window-operator will close the windows for him. Little strips of blotting-paper serve as moisture detectors, and can be made so sensitive that they will operate to close the windows when the dew falls, or can be fixed to work only when it rains.

The automatic window-operator is attached to a sash equipped with balance weights. A drop of moisture on the strip

of paper outside causes the mechanism to operate a spring, and the spring draws down the sash. An inside connection of all the sashes on the same side of a house can be made, so that only one automatic operator outside is necessary, the working of this "master sash" serving to close all the windows.

If it is desired to have the windows closed at a certain hour of the day or night the system can be connected with an alarm-clock, and at the fixed time *click! click!* will be the only sound as all the windows close.

An Eskimo Duel Is Fought by Tongue

'YOU'RE a mean, ugly brute, and your face reminds me of a chunk of ice,' said one Eskimo to another, and the surrounding villagers roared with laughter. That's how the Eskimos in Greenland's icy mountains fight their duels—with their tongues. They pick a suitable time and place for meeting and then notify the villagers.

They take turns at singing, dancing, beating drums, and hurling sarcastic remarks at each other. While one opponent performs, the other one must grin and bear it. Then he gets his chance at tongue-washing. They are both given several opportunities to tell everything they know and think about each other. They even drag in the sins of their ancestors, if they can do it in a particularly insulting fashion.

Which one wins? The one who can get the greatest number of laughs out of the audience. And as for getting satisfaction—is it not much more gratifying to tell a man just what you think of him than to stab him in the ribs?—CHRISTIAN LEDEN.



When the Eskimos of Greenland fight, they do it with their tongues; they take turns at singing, dancing, and hurling witty sarcastic remarks at each other and the surrounding villagers decide which one wins.

One small tender plant must stand the baleful glare of eight electric light bulbs; its growth is being photographed by an automatic moving picture camera. This camera is very useful in photographing plants of slow growth.



The Camera Takes Its Own Pictures

IF a tender young plant doesn't die of fright when it sees eight large electric-light bulbs staring it in the face, then its growth will be automatically photographed with the aid of those same eight bulbs. They are part of a new automatic motion-picture camera recently invented. There are two timing clocks, one for switching on the lights every so often, and the other for shutting off all power when the necessary number of exposures have been made. Two relays start and stop each exposure.

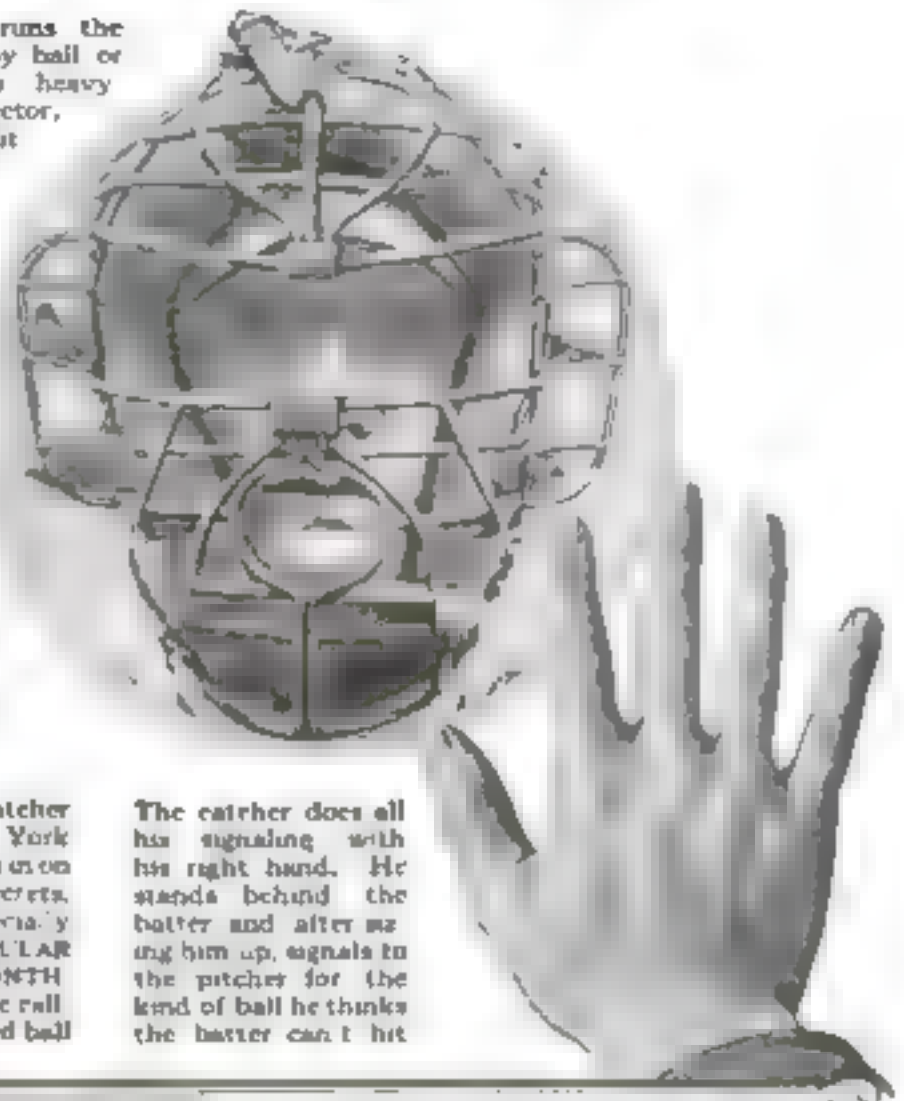
You set the clock to the interval desired. Usually, in the case of growing plants, this interval is one half hour. The only attention the automatic camera needs is a daily winding.

Heretofore, when long-period pictures were made, three camera-men were needed. They worked in eight-hour shifts. But the new camera will work by itself, and may be used for photographing any kind of slow growth, such as the development of an animal or insect, as well as the growth of plants.

The Catcher Gives the High Sign



A catcher always runs the risk of being hurt by ball or bat. He wears a heavy mask a chest protector, and knee-guards, but they don't prevent him from having frequent sprained or broken fingers.



Earl Smith, catcher for the New York Giants, lets us in on some of his secrets. He posed especially for the POPULAR SCIENCE MONTHLY. He is here calling for a curved ball.

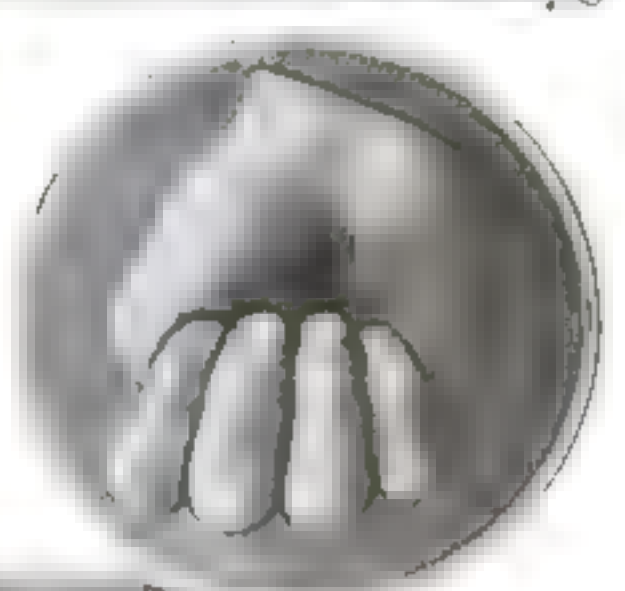
The catcher does all his signaling with his right hand. He stands behind the batter and after seeing him up, signals to the pitcher for the kind of ball he thinks the batter can't hit.



In the days of Nero this used to mean "thumbs down" he must die. Now it means send over a curved ball. How times and amusements have changed together!



The waste ball signal above is not very different from the fast ball signal. His fingers are still stiff and straight, but they are parted—with the thumb and the first finger clinching together.



When he tucks his thumb under his closed fist he's not getting ready to punch someone—he's simply signaling for a spit ball, hoping for the verdict, "He's out!"

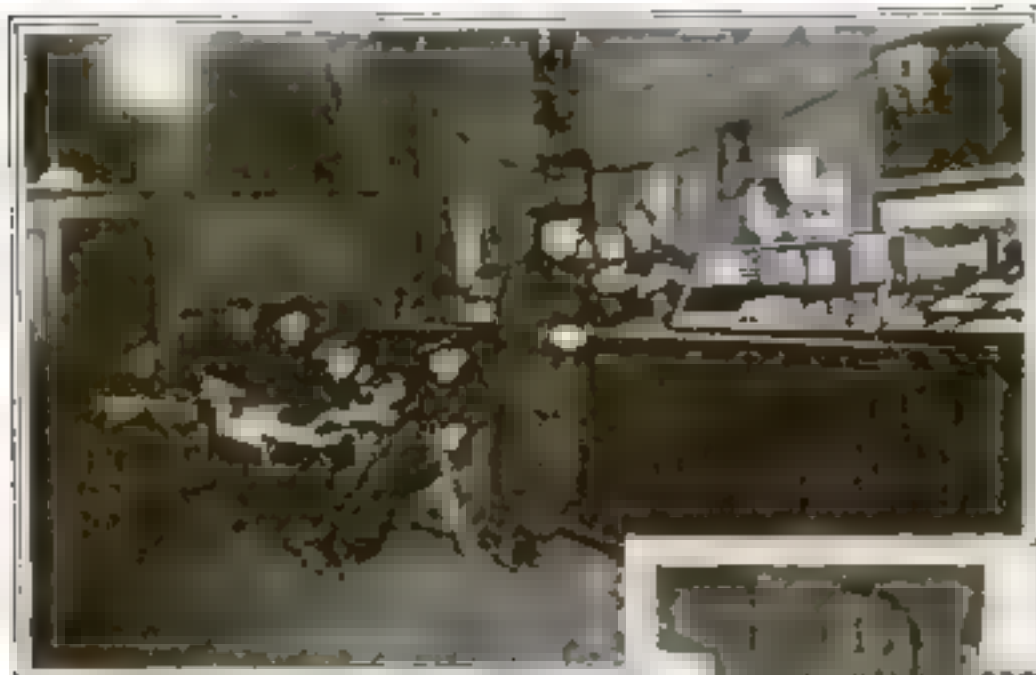
A knuckle ball is a hard ball to throw and a hard ball to signal for. The catcher knuckles down his first two fingers and lets his thumb and the other two stand up straight. Try it.



When he holds his fingers close together and keeps them very straight, he's calling for a fast ball. To the uninitiated all balls look alike, but the shifty moundsmen uses change of pace.

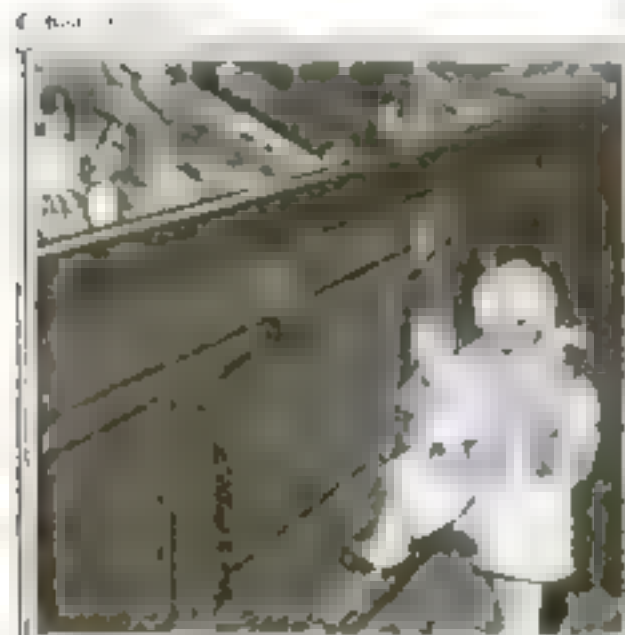
What to Do with an Old Barroom

Under prohibition books supplant beers and toys the toper



DAVIS had this new head—this is the first of many that will be seen in the new barroom.

When a man is with a woman, he is not supposed to be with her. New York Y. M. C. A. is the only place where a man can be with a woman.



Prohibition is a very good thing for this young rascal. He has learned the bar step already—the first step downward.



"One Lone Ranger" said she with her foot on the bar rail. It was neither a hard nor a soft drink—it was a book. This little barroom in the Hotel Majestic, New York, has been turned into a book store.



Imagine the feelings of the man who stands for a fitting on the very spot where he formerly drank his beer.



No longer is free lunch served here. You have to buy it and the only thing you can add to the lunch is a package of cigarettes.

A Mechanical Genius of the Back Woods

Without schooling or training of any kind, he has made himself a cunning artificer in wood and stone

By A. F. Harlow

THOMAS COKE RICE is a Tennessee mountaineer who lives in one of the wildest and most inaccessible portions of the narrow, high, deeply seamed plateau known as Walden's Ridge. An almost unbroken forest extends for several miles in all directions from his home, and a lone cabin three miles away shelters his nearest neighbor. In this lonely spot he has lived for twenty of the twenty-five years of his life. He has never spent an hour of his existence in a school-room, and until the draft caught him in 1918 he had never been more than twenty miles from home. Yet he is a cunning artificer in wood and iron. Had he had the opportunity for mechanical training, he might have been a wonderful craftsman, a manufacturer, an inventor—who knows?

I first saw "Coke" seven years ago. At that time his mother "believed" he was about eighteen years old. The mother is a fine example of the Spartan heroism and stolid endurance common to the Southern mountain women. Her husband left her when Coke and his sister had not yet entered their teens. He rode away on the only horse possessed by the family. The agony of the bitter struggle with poverty during the years that followed can never be told in words. The mother, assisted by the two children, succeeded in raising each year a tiny patch of vegetables near the house. She would walk through all kinds of weather to a settlement six miles away, where she did any sort of work she could get to do.

As the children grew older, the three were able to put half or more of their three-acre clearing into cultivation. Their only implement was an old bull-tongue plow, and, having no horse they took turns pulling the plow. Then there



"Coke" as he is called, made every part of this forge and blower, excepting the sprocket wheels and chain. And the construction was all his own work. If he had gone to school, he might have been a great inventor. Perhaps it is not too late yet for the young mountaineer to have his chance.

was wood to be cut and brought in from the forest, and in this work the children each "made a hand." The mother has a strong strain of the old Cherokee Indian blood in her, and this, combined with the hardy moun-

tain stock, accounts for the indomitable courage with which she and her children endured their trials. As Coke grew up, he showed a disposition to tinker with the few tools at his disposal, and began to do repair jobs with remarkable skill. One of his first real creations was a jumping-jack, a crude wooden toy manipulated by a string, the original of which he had seen in the possession of a child at the settlement. When I first ran across him seven years ago, he had already made considerable progress. He had built a little forge out of stones and earth in the yard, and was doing blacksmithing. With a frow, an edged tool used in the country for splitting palings and old-fashioned shingles, he had split out two slabs of oak for the sides of his bellows, and had shaped their edges with his jack-knife. A piece of an old buggy-top served for the leather portion of the bellows. He hacked and whittled out a handle and frame, and soon the forge was in operation. Among his first products were table-knives and butcher-knives, most of which he made out of old wagon-tires. He applied wooden handles, making the tiny rivets with which they were fastened, and sharpened the blades on a grindstone which he had slowly and laboriously fashioned from a chunk of mountain sandstone. He occasionally found sale for these tediously made tools at the settlement at small prices.

It so happened that I did not see Coke again until the summer of 1919. I found that he had greatly enlarged his list of products. Instead of a bellows he now has a rotary blower, of which he made every part except two sprocket wheels and a chain, which he salvaged from the wreck of two old bicycles, and some scrap tin with which the fan is



Thomas Coke Rice, a Tennessee mountaineer, and his mother and sister have lived in the wilds all their lives. He never went to school yet he is an expert workman in wood, stone, and, what he likes best of all, iron.

encased. He got the idea of the machine from seeing a small portable forge in operation at a coal-mine several miles from his home. He has equipped his blower with a treadle as well as a crank, so that he can run it with both hands free to tend his fire and turn his iron. And that blower creates some wind, too!

Coke apologized for the unevenness of the blades on the fan. "I didn't have no square to true 'em up with," said he. He apologizes thus for many of his products. "That ain't made just as it ought to be," he will say; or, "I could do better next time." He seems to have no illusions as to the quality of his handiwork.

He makes practically all the tools that he uses in his farm-work: hoes, mattocks, axes, hammers, hatchets, frowns, and so on. It is true that they will not hold an edge as well as steel tools, but he gets much good service out of them. He makes hinges for the gates and doors on the place, as well as latches and bolts for the latter. A razor-back pig comes squealing up to the fence with a small bell clanking at its throat, and you learn that Coke made the bell. He is constantly on the lookout for old iron that he can remelt and use in his work. Parts of old wagons, plows, and other agricultural machinery, discarded tools—all's grist that comes to his mill. Of course he must always carry such junk several miles, either on his shoulder or on the back of the old mule that he now possesses, and of which he is as proud and as careful as if she were a race-horse.

Coke works very skilfully in wood, though he does it, as a rule, only when necessary. He has made some gunstocks that can't be beaten by anybody. He built a kitchen cupboard for his mother, and had no dressed lumber out of which to make it, either—just a few pieces of rough stuff, and the rest he sawed out himself. He made a plane with which to dress it, even making the blade of the plane in his forge. Ordinary kitchen chairs are easy for him, but his best job in the line of furniture is his mother's large, comfortable rocking-chair, which has knobs and curves not easy for a man to achieve when he is absolutely ignorant of geometry or of design, save in a purely intuitive way.

As an example of the expedients to which he has resorted on many

occasions, Coke some time ago found in a deserted cabin the burrs or grinding portion of a coffee-mill. He took this home, cleaned and removed the rust from it, built a box for it, forged a crank and attached it, and then, being in a hurry, stuck a piece of corn-cob on the crank for a handle! The cob does just as well as a polished handle; the calloused palms of the family don't mind its roughness. In this mill the family not only grind their coffee, but grind their corn into meal.

This makeshift handle is an indication of the fact that Coke doesn't care

can make them of all sizes, from the big five-inch-bladed jack-knife suitable for skinning animals or for cutting one's way through a rhododendron thicket, down to the tiny knife shown in the accompanying picture, whose handle is only a trifle over two inches long. The blades shut up easily and accurately into the case, just like a factory-made knife. The handles he makes from cow's horn or from bone. He admits that he has sold two or three of these small knives for as little as twenty-five cents apiece!

Coke still suffers from a lack of adequate equipment. For an anvil he has only a heavy steel axle, fastened across two blocks of wood. The thimble serves as the horn of the anvil. When we first visited him last summer, he expressed a hope that he could some day have an emery wheel on which to sharpen his tools, the ordinary "grindin' rock," as he and all mountaineers call it, being too soft. He has since been supplied with this article.

He digs the coal that he uses in his forge from a vein that outcrops under a cliff two and a half miles from his home, and brings it in, a boxful at a time, on his shoulder.

Coke was taken into the army in the spring of 1918. The mountain soldier did not get any farther than Camp Pike, Ark. No one in the army seems to have comprehended his gifts. He was much interested in the automobiles and trucks he saw, and begged to be allowed to work at something in the motor department, either as driver or repair-man. But he was esteemed too ignorant to be allowed to touch machinery.

There may yet be time to save this latent genius from sinking into the sullen apathy and ineptitude of the ordinary unambitious mountaineer. A few more years in his present surroundings, and his gifts will be lost. He

much for woodworking, anyhow. He says so. Iron is his true love. He will even work in stone at times.

It is twelve miles from his home to the nearest grist-mill. He decided recently that he wanted a little mill of his own. So he has been slowly working out a pair of small millstones, using a variety of mountain sandstone, which is welded together with so much iron that it might almost be called a low grade of iron ore.

But probably his cleverest work is displayed in his pocket-knives. He

says he would not stay in his present forlorn location an hour if it were not for his mother. She clings to the spot with the unexplainable, feral instinct of the old mountaineer, who sickens and shrivels when away from the big hills. Coke hasn't developed his gifts along the lines that would mean most to himself and others, because he doesn't know how to do so. He doesn't know how to get his wares to the proper market. He doesn't know how to capitalize his talent. Who will give him the chance?



In the top picture are a few of the many crude tools and instruments Rice has made. He can make all kinds of pocket knives, from the big five-inch bladed jack knife suitable for skinning animals to very small ones. Compare those shown in the middle picture. The lowermost picture shows two millstones and four tools. Rice made them all.



The Unbarbered Ainu

IMAGINE 20,000 men in Japan who have been in need of these things in their adult existence! In the northernmost islands of Japan live the Ainu, or hairy men.

Science hints that these curious folk may be of remote Caucasian descent, though they undoubtedly emigrated originally from the Kuries. When they came to Japan they killed the race of pit-dwellers, the dwarfs who knew the art of pottery and could make flint arrow heads. Then later came the Japanese, who drove the Ainu to the northernmost island of Yezo.

These backward people take on nothing new. They eat with chop-sticks and use mustache-razors—indeed a necessity.

Sprinkling the Envelopes

GOOD-BY, old sponge and dirty bowl! You have mused up the office desk long enough. An Illinois manufacturer is making an efficient aluminum envelope-moistener.

An aluminum cap fits tightly over an aluminum can which is about two inches in height. Water is poured into the can and when it is turned upside down, the water comes out through tiny holes in the cap.

No sponge is required in using this moistener. The small holes permit only a little water to flow out of the can.



The new envelope-moistener is really a small watering-can, the lid is perforated

(Right) The pneumatic tent used by the U. S. Army. The tent is composed of material which can be inflated by a pump.

The tent is composed of material which can be inflated by a pump.



An Airplane Tent Hospital

HERE is an airplane ambulance that carries a tent for a temporary hospital. The tent is composed of material

which can be inflated by a pump.

The tent is composed of material which can be inflated by a pump.

The tent is composed of material which can be inflated by a pump.

The tent is composed of material which can be inflated by a pump.

The tent is composed of material which can be inflated by a pump.



On a small island in the Great Salt Lake thousands of pelicans live even though they have to fly many miles for their food.

Put Up Your Umbrella When Among Pelicans

ABOUT twenty miles from Saltair Utah, on the Great Salt Lake, is Bird Island, recognized as the sanctuary of pelicans. Bird Island derives its name from the fact that only birds—and, in fact, only pelicans—live on the island in the great inland body of salt water.

There are countless thousands of pelicans on the islands, and many tourists leave Salt Lake City every summer to spend a few hours there. The birds are so thick, and fly so low, that most persons tour the small island with either umbrella or parasol open to prevent the pelicans from alighting on their heads.

There are no fish in Great Salt Lake, and many have asked how the pelicans live. Inquiry shows that the older pelicans fly every morning to Utah lake, about thirty miles distant, and consume a meal of fresh-water fish, and then return with their pouches full to feed the younger pelicans.

Bird Island is nothing more than a rocky structure. There is no human habitation there. Neither is there any vegetation. The reason for the pelicans remaining at Bird Island and making the daily flight to another lake for food has never been fully explained, although fish and game officials say that the pelicans understand that they cannot be molested at the island, and that therefore the sanctuary in Great Salt Lake will always continue as their permanent abode.

Where Time Counts Not

WHAT'S all this for?" one would surely ask if he visited the bank of one of the sluggish yellow rivers in the vast domain of China, and saw a bull slowly walking around in a circle under a bamboo canopy. "Is it some queer religious ceremony?"

Not at all!" the guide would reply. "Here in China many people follow the beaten paths of their fathers. This man is urging the bull to trudge around the treadmill of a pump which draws up the water from the river and empties it into a narrow irrigation-ditch.

"Of course a gasoline engine and pump would do the work better, but it may be a long time before they want to use modern things out here."



On the bank of a river in China, this bull operates a treadmill, thereby conveying buckets of water for irrigation



Reproduction of the
American Museum
of Natural History

A great flying reptile so constructed that it must have been a marvel unsurpassed in soaring flight.

When Kansas Was a Sea

AT the time the gigantic flying reptile shown above soared in the sky, millions of years ago, western Kansas was in the heart of a great inland sea.

The toothless *Pteranodon* measured twenty-one feet straight from tip to tip across the wings. A large condor might extend as much as thirteen feet stretched out, but in proportion the ancient flying reptile weighed less. It was all wings and head, the wings being covered with a thin leathery membrane like the wings of a bat. Little claws at the side of the "wing-finger" enabled the creature to hang like a bat while resting.

Mr. Handel T. Martin, curator of the Geological Museum of Kansas University, discovered the *Pteranodon* in the chalk deposits of western Kansas. The mounted skeleton may now be seen in the Museum of Natural History, New York.

Veils for Horses

WHEN a horse wears a veil across its face just below its eyes it is not trying to look as if it came from a harem, but is attempting to keep the flies and gnats from landing on its nose and lurching there.

The end of a horse's nose is a favorite meeting-place for bugs. In fact, some of them try to raise their families there. And the horse is helpless. Its tail won't reach around that far, and its bit restrains its tongue. A veil is its only protection.



These horses are not trying to be beautiful, their veils ward off the bugs that try to live on a horse's nose.

A Curious Clock

"THAT is a curious clock in your shop window; will you tell me about it?" the stranger asked.

"Well," said the inventor, Mr. S. C. Swindler, "having an idle clock in the house, the thought struck me that I could make that clock operate a large sign which I thought I could myself manufacture. I went to work, and in three days had it crudely operating my sign. I spent my spare time for three years improving the device, and now you see how it works."

The works of the clock operate circuits of electric current which cause the letters of a sign to flash. A very small per cent of current is used, since the clock takes the place of a motor.



The works in this clock operate a mammoth electric sign.



These are some of the targets at which the United States battleships fire when they try out their guns.



© Kodel & Herbert

The parrot that called "Ma, come get 'em!" and caused the arrest of a burglar.

The Parrot Burglar-Alarm

"MA, come get 'em! Ma, come get 'em!" was the cry that rang shrilly through the stillness of the house.

Cecil Sherman, the ten-year-old daughter of Samuel Sherman, knew at once what the parrot meant, for the family pet had been trained to pronounce this phrase at the sight of strangers.

The girl ran upstairs, and brushed against a strange man coming down the stairs. She ran after him as he darted from the house, and was joined in the chase by her cousins Julia and Sadie. The girls were better runners than the man, and when they caught up with him the three held him until a policeman came and arrested him.

Targets of the Big Guns

BOOM! The great guns are firing. As the smoke clears and the rumbling echo rolls away, the sailors watch eagerly. Did they hit the target? From the deck of the battleship the targets look like tiny black patches with white spots in the middle. But a close-up view is quite different, as you see in the picture below.

On target No. 175 three hits are plainly seen. The numberless target next to it boasts of three patches that cover up holes made in an earlier test.

Do Spirits Talk through the Ouija Board?

Perhaps it is that subconscious ego
whose memory is better than yours

By A. J. Lorraine

ABOUT you hovers the unseen. You place the ouija board upon your knees or on a table, and let your hand rest lightly on the planchette, the little three-legged carriage that rides over the ouija board. See that you are comfortably seated, and your arms not cramped, but free to move. Stop your thinking, machine; try to make your mind, as far as possible, a blank. If you want a successful séance, see that the circle of friends about you consists of persons who take a serious interest in the proceedings. Scoffers are not helpful; a quiet, serious atmosphere is most favorable to good results.

A time passes in silence. The right conditions must be allowed to establish themselves.

Look—now the planchette stirs. A hidden power seems to move it. At first a few straggling, random movements. This may continue for a while. Presently, pointing, one by one, to the letters of an alphabet printed on the face of the board, the planchette begins to spell out a message.

M . . . A . . . N . . . Y M . . . O . . .
O . . . N . . . S A . . . G . . . O . . .
I L . . . I . . . V . . . E . . . D . . . A . . .
G . . . A . . . I . . . N I C . . . O . . .
M . . . E . . . P . . . A . . . T . . . I . . .
E . . . N . . . C . . . E W . . . O . . .
R . . . T . . . H M . . . Y N . . . A . . .
M . . . E . . .

With these words one of the most remarkable personalities that ever spoke through the ouija board announced herself to the world. It is sometimes said, in criticism of those who inquire into occult phenomena, that nothing but trifles and dribble ever comes to us from the agencies, whatever they may be, that speak to us through mediums and other unusual channels.

Anyone who says this has either not read the communications of Patience Worth, through the hand of Mrs. Curran of St. Louis, or else is wholly devoid of literary sense. Read the book and judge for yourself. Selected excerpts from the records have been col-



Skeptics are disappointed in the character of the messages received with the aid of the ouija board. They forget that even the greatest of us are but human beings. Sir Isaac Newton did not always discuss mathematics at the breakfast-table; nor Napoleon the best ways to win a battle. It is much more to the point if the spirit of Newton refers to a special dish of which he was particularly fond in his lifetime, and if on investigation we find his statement to be true, than if he were to dwell long and learnedly on gravitation.

lected into a volume by Casper S. Yost (Henry Holt and Co., publishers). There you will find romantic tales of times long since past, and a series of poems of singular charm, written in a quaint old English dialect. And the remarkable thing is that Mrs. Curran, through whom the communications came, is herself not a writer, and the very language in which they are couched is strange to her.

Patience Worth claims to be the discarnate spirit of a person that once walked this earth, even as you and I. What does psychic science have to say

about it? To understand the situation, you must begin by understanding yourself.

Ordinarily your hand obeys your will; its motion fulfills some conscious purpose of your mind. When, therefore, you find the planchette under your hand performing movements and spelling out words that were not in your mind, and which you had in no wise purposed, you are naturally surprised.

One explanation that presents itself for this strange course of events is that some unknown outside influence, perhaps a spirit, guides your hand, irrespective of any knowledge or purpose on your part.

Are You Absent-Minded?

And this is a possible explanation. But, before we finally adopt it, let us pause for a moment. Think: in the ordinary course of life, do you not sometimes perform actions that are not controlled by any conscious act of the will—actions, per-

haps, that are even contrary to what you intended? Are you never absent-minded? Have you never handed the conductor on a street-car a transfer and held out your hand for the change? Have you never dipped your pen in the mucilage bottle? Or, if not that, then some equally absurd lapse you surely have committed sometime, as sure as you are human, though you may not have gone so far as the young man who started to take a girl to an ice-cream parlor and found himself escorting her to the undertaker's.

Such lapses remind us that many of our actions are automatic. You exercise your will to decide the main issues, and then leave the execution of the details to—to what? Well, psychologists call it your subconscious.

THE war has done so much to revive interest in the ouija board that the POPULAR SCIENCE MONTHLY has decided to approach the whole subject of spiritualism with an open mind. It will not do to accuse those who manipulate the ouija board of being frauds; there are too many of them. Besides, it is the business of science to investigate and not to prejudge. In this article the author sets forth the results of investigations that have been conducted by psychic researchers for years. It will be followed by articles on other phases of spiritualism.

self. This other self is a very remarkable person, even though once in a while he plays curious pranks with us by doing the right thing at the wrong time. "I am not going to say that your other self is in all things your superior; in some of life's affairs your dominant conscious ego has to hold the helm. But in some things the subconscious or subliminal self is indeed your superior. His memory is phenomenal. It seems almost as if he never forgot anything. Ordinarily he takes a modest place in the background, so that, though you have been living with him all these years, you may hardly have noticed him at all. But there are ways of drawing him out into the light, where you can observe him. He notes many things that you pass by unobserved. The clock has just struck the hour. You did not count the strokes. But it is not too late. Though you were paying no attention, he was on the job; he kept a memory record of the sound. And in your mind you can go back and count the strokes.

Subconscious Memory

There is not a second in your waking hours when you are not constantly receiving impressions through your senses. Your eyes are open and are seeing something or other as long as you are awake. How much do you remember of what you see? Far more than you ordinarily suppose—at least, if "you" means both of you, your ordinary self and your subconscious self.

Perhaps you say, how do I know that the subconscious self remembers so much? As long as I am not conscious of what he remembers, how can I test his memory?

There are several ways of digging down into the memory of the subconscious self—that is to say, into your subconscious memory. The first method is very simple. Select any little incident in your life—something quite trivial, say. To start with something easy, you may pick out



A revived form of an old pastime. A wedding ring suspended from a thread tied to the fingers performs various automatic motions. The more usual method is to put your elbows on the table, hold your hands against your temples, with one end of the silk thread at each temple, the ring hanging in the loop of the thread under your chin and swinging to and fro in a wine glass. It counts out answers to your questions by striking the sides of the glass, so it is believed.



Mrs. John H. Curran, of St. Louis, through whom "Patience Worth" has communicated a number of romantic prose stories and poems.

to exchange a few words. Whatever it may be that you select for the experiment, fix your thought on that event in a dreamy sort of way, and let your thoughts drift freely around the various associations that come to your mind in connection with the incident. Do not make any effort to recall things; just let your thoughts come floating in as they will. You will be surprised at the amount of detail—trivial detail—that you will thus find streaming back to your mind. The faculty of thus resuscitating memories can be improved by practice, and is not without its use. It may help you sometimes to recover articles mislaid or lost.

But what, you may ask, has this to do with the ouija board?

One of the several methods of tapping the subconscious is with the aid of the ouija board, or, more generally, of automatic writing. For the planchette is not necessary; it is merely an adjunct to facilitate the process. Certain persons possess the natural faculty of automatic writing. If a pencil is placed in the hand of such a person and is allowed to rest on a piece of paper, and if this person takes his attention off the action of his hand, for instance, by reading a book or by engaging in conversation,—presently the pencil between his fingers starts to write, tracing words and sentences having no relation whatever to the book or the conversation. It is just as if some other person were writing. The operator himself (or herself) does not know what has been written, any more than do the other persons present, until the writing is inspected.

The Case of Miss C—

Then, it is often found to contain references to experiences that had been long forgotten by the subject, and that frequently cannot be recalled even after the writing is deciphered, though other evidence may establish

and he tells us that the famous Mrs. Gamp, perhaps his greatest creation, often spoke to him "with an inward monitory voice." Robert Louis Stevenson ascribes his inspirations to Brownies, who "tell him a story piece by piece, like a serial, and keep him all the while in ignorance of where they aim." Instances of this kind might be multiplied. Briefly, we may say that genius seems to consist in an unusually close contact of the conscious self with the subconscious, an unusually developed power to summon up before the view of the fully awake mind the dim phantoms with which the subconscious realm is peopled.

Psychology Explains Much

Are the revelation of the ouija board and other modes of automatic writing, then, to be wholly explained in the matter-of-fact terms of psychology? Is it all just a freak of the intricate workings of the human mind and body?

This does not follow. Psychology sheds light on the situation, and perhaps explains much. But there is seemingly also much that remains unexplained. So, for example, in a seance reported upon by F. W. Myers in his work on "Human Personality and Its Survival After Bodily Death," the operators of the ouija board were placed out of sight of the company, who in silence selected a photograph from an album and fixed their attention on it. Presently the ouija board began to spell out either the name or the initials of the person whose photograph had been selected, or else it wrote out some characteristic feature descriptive of the picture. Out of five cases three were correctly identified.

In another case a series of questions were put to the board: "How many shillings has Miss X in her purse?" "Four" (correct). "How many coins in my purse?" "Five" (correct, though the interrogator thought he had many more). A card was picked at random out of a pack, looked at by one of the party, and then laid face down on the table. "What is the color of the card?" ouija was asked. "Red" (correct). "What number?" "Seven" (correct). "What suit?" "Hearts" (correct).



Not only handwriting, but also drawings, have been produced by the automatic motion of the artist's hands. Such drawings, it is remarked, have a certain value for the artist which they do not possess for the ordinary individual.

Another instance cited by Myers has an amusing side. The pencil in the hand of a certain lady gifted with automatic writing persisted, on one occasion, in writing time after time the word "Goat." She was then informed that the gentleman standing beside her was named Nanney.

In instances such as these, which are well authenticated, the ouija board and automatic writing generally seem to give marked evidence of telepathy or thought-reading. But there are cases in which the hypothesis of telepathy must be strained almost to

the breaking-point to account for messages received. Dr. Hyslop, in his book "Contact with Other Worlds," cites a number of such examples.

On January 28, 1902, Dr. Hodgson suggested to the alleged spirit controlling the famous medium Mrs. Piper that he should impress the daughter of

Mrs. Verrall, in England, with the view of a person holding a spear in his hand. The medium replied: "Why a sphere?" Dr. Hodgson corrected her "A spear." The control agreed to try. Both Mrs. Verrall and her daughter are noted mediums. On February 4 of the same year Mrs. Piper's control reported to Dr. Hodgson (this being the first seance since the giving of the message) that he had succeeded in transmitting the message about the "spear" (so Mrs. Piper spelled it). Meanwhile Mrs. Verrall had, on January 31, received through her automatic script a message partly in Greek and partly in Latin, which translated read as follows.

"A universal seeing of the sphere fosters the mystic joint reception. Why did you not see it? The flying iron [Latin idiom for spear] will hit."

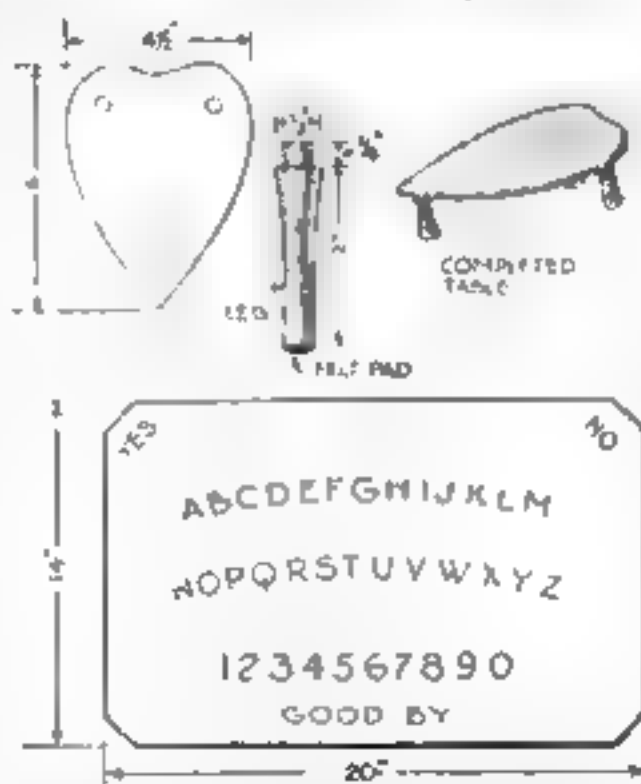
Mrs. Verrall is a classical scholar, so the receipt of a message in Greek and Latin is not in itself very surprising. Still more remarkable, therefore, is the case of a message given by Mrs. Verrall to her control in Greek, and repeated together with the translation and the reply by Mrs. Piper in America, though this lady is ignorant of the ancient languages.

Another Automatic Script Case

In other cases automatic script has been found to bear a marked resemblance to the handwriting of a deceased person purporting to be the author of the communication. Material of this kind has been obtained particularly by Mr. B. F. Underwood through the writing of his wife. Says he

"Fully aware that, under certain conditions, from the submerged self may be sent up memories which cannot be distinguished from newly acquired knowledge, still, I am confident that Mrs. Underwood's hand has written names and statements of facts, not only once but several times, which were not part of her conscious self."

How to Make a Ouija Board



A homemade ouija board that "answers" questions fluently can be made from a clear perfectly straight board about 20 inches long, 14 inches wide and $\frac{1}{2}$ inches thick. Round off the corners and sandpaper it until smooth. Trace on it the letters of the alphabet with a pencil, and black them with a brush; also trace the words "yes" and "no," and the numbers, and at the bottom the word "Good by." Coat the board with two coats of varnish, and rub smooth. While the board is drying the table can be made. Cut from a board of $\frac{1}{2}$ -inch material a heart-shaped piece $4\frac{1}{2}$ inches wide at the widest point and 6 inches long. Next make the three wooden legs 2 inches long and glue them into holes in the under side of the table. Cut three disks of felt from an old hat and glue one to each foot of the little table.



Tiny II's neck-watch carries his name and address, so it's really a dog-collar

This Little Dog Wears a Neck-Watch

TINY II, dog, was given a wrist-watch and he didn't know what to do with it. He wore it on his front paw for a while, but he was always buying new crystals for it.

He now wears the watch around his neck. Of course it's not of much use to him there, but he doesn't know how to tell time, anyway. His initials are on the outside, together with his address, thus the watch takes the place of the plate on a dog-collar.

A Monster Beavers' Dam

IN Taylor Creek, Bayfield county, Wisconsin, beavers have built a great dam. It is twelve feet high and a quarter of a mile long. The house is in the center. It is sixteen feet high and forty feet wide at the base. The sleeping compartment is large enough for a tall man to lie down in.

The floor is covered with a dry compound and is spotlessly clean. When man invaded the dam a large quantity of food was found stored there.



A human family could live in the house in the center of this beavers' dam, the dam itself is a quarter of a mile long

Wrecked by a Tank—a Water-Tank

THIS is what a tank did—not the tanks that did such damage in the war, but just a peaceful old water-tank.

A 10,000-gallon tank carried on a 75-foot steel tower, and used in fire emergency, became so encased with ice that the additional weight was declared unsafe, and the tons of ice were removed under orders from the Building Inspector. On the night following the afternoon when the ice was cleared away, the steel structure supporting the tank collapsed, and the huge weight crashed to the ground, completely wrecking a four-story building. Damage to the extent of \$100,000 was the result.

No one was in the building except the night fireman. He was in the basement of the building, and was rescued by a passer-by who pulled him through a grating in the sidewalk. Luckily, he escaped without injury.



When a huge water-tank charged down from its 75-foot perch above the courtyard of a factory, it wrecked a four-story building



As soon as a memorandum has been attended to, the segment on which it is noted can be slipped out

A Memorandum-Pad that Comes in Sections

"**CALL** Mr. Hanley," says a memorandum on the desk-pad. Now, when he has been called, what is to be done? Should the page of the memorandum-pad be torn off, what about the other memoranda on the same page?

The simple way is often the best way. There is a handy memorandum-pad having four divisions for each leaf. When Mr. Hanley has been called, all one has to do is to slip out the section on which the memorandum was written, leaving the rest of the memoranda undisturbed.

Only one hand is required to remove one of the segments. The holder contains enough filler to supply the average office man four or five months.

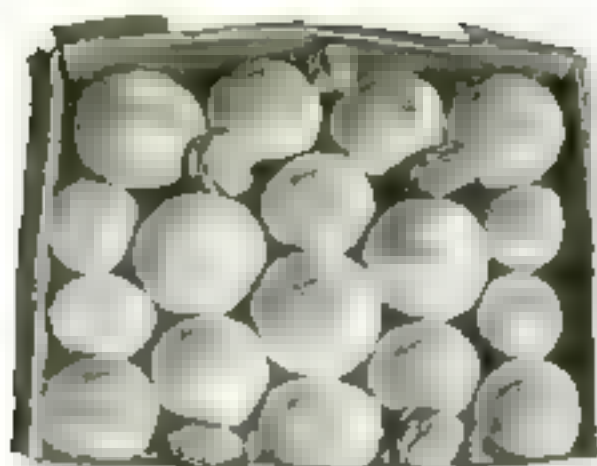
See the Meridian

"**EAST** is east and west is west, and never the twain shall meet," said Kipling, but he was wrong. In the picture below you can see the meridian line where east meets west and to make the matter more interesting a man has one foot in each.

The meridian is an imaginary line from the north to the south pole, passing through Greenwich, England. On the road to the observatory there, the meridian is actually dug out of stone.



At Greenwich, England, the meridian—an imaginary north-to-south-pole line—is indicated in the stone road



The fruit-grower now brands his fruit, and you soon learn which is your favorite brand and order it by name

Branding Fruit and Vegetables Without Injury

"A CAN of So-and-Su's baking powder, a bottle of Blank's ketchup—" You can safely order your groceries by the telephone because they are labeled. But fruits and vegetables wear no protective labels.

However, there is now a fruit-branding machine, invented by Ansel Wysong, of Los Angeles—the man who devised the walnut-branding machine. Oranges, lemons, grapefruit, apples, and even tomatoes may be labeled without injury. The machine works on the vacuum principle.

Bookkeeping of Cooks

WHEN you order breakfast at a fashionable New York hotel, the waiter does not shout to the cook, "One up on the ham and egg!"—oh, no! He writes your order down and then quietly disappears kitchenward. He approaches the cook with his pad in hand, reads off the order, and the cook in turn writes it on a pad, one of many lined up on a shelf. Then he puts your ham in the pan.

There is a pad for each kind of order, and the cook is very careful to write each order in its proper place. At the end of a day he is able to tell at a glance the number of ham-and-egg orders for instance, that he has cooked. All orders are carefully checked up and there is very little chance of error.

This Bad Man Gave the Sheriff a Jolt

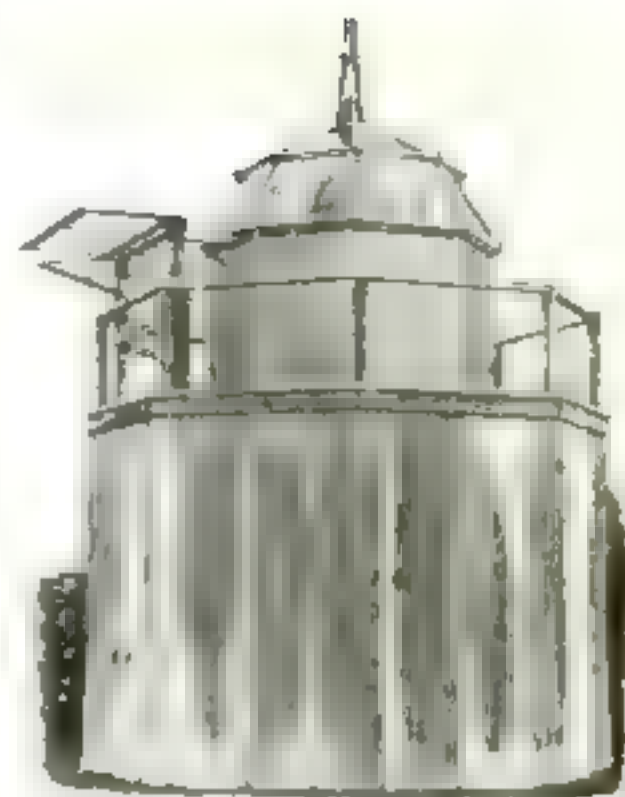
A MISSISSIPPI sheriff left a prisoner securely locked in his room at the hotel. Yet, when he returned, the prisoner was gone. The room was on the fifth floor, and there was no fire-escape.

When the sheriff left the room the prisoner was calmly reading a newspaper. When he returned he found the door still locked, and the newspaper lying on a chair.

Later the man was captured, and induced to tell how he had escaped. The sheriff had left the key in the door after having turned it. The prisoner, suspecting this, slipped his newspaper under the door, then, with one of his own keys, he pushed the hotel key out of the keyhole. It fell on the newspaper, and the rest was easy.



This bad man is locked in his room, but he is forcing the key out of its lock so it will drop on the newspaper and he will then pull the newspaper into the room with the key resting on it.



© Kiedel & Herbert

A series of these lighthouses would pilot airplanes safely for great distances across country in bad weather.

Pillars of Light to Guide the Airman

AT Hounslow Aerodrome, in England, a lighthouse has been erected to guide airmen at night and in bad weather. A beam of light of 70,000 candlepower is sent vertically into the sky, illuminating the dust and moisture in the atmosphere and standing like a luminous pillar.

The pilot flying above a fog can see a spot of light on the cloud-floor beneath his machine, and he knows that the landing-field lies below.

Get Ready—Sneeze!

GET ready! Set! Sneeze! These orders are given to a group of nose patients in the Hattersea General Hospital, and at the word sneeze they all chime in. It has been found that sneezing helps the prevention and treatment of nasal complaints.

At the word "Get ready!" each patient dips a feather in a saucer containing vasoline. At the word "Set!" they sniff the feathers. Then they sneeze in chorus.



© Photo Illustration Co., Inc.

The cook has a pad for each different order, which makes it easy for him to check up the things he cooks each day.



In about three seconds they will all sneeze on the feather-tips in this room: sneezing helps in the treatment of adenoids.



A device for lifting water from a lower to a higher level by rotating the vertical tube.

Whirling Water Uphill

A NEW water-elevating device has been invented by Mr. Leon Shevchenko, of Cortland, N. Y. A vertical tube fitted half way up with a system of horizontal pipes is rapidly rotated, the centrifugal force causing the water in a lower level to flow upward and outward through the pipes.

The scheme, carried out on a suitable scale, might be handy in draining pools on a farm. On a larger plan the motive power could be supplied by a gas-engine.

A Bedroom Pet

IN the leafy trail of the dark forest one listens for the breaking twig that whispers, "Watch now and you'll see a deer jump out of the brush!"

But Mme. Clothilde Sakharoff, the exponent of a new phase in the art of dancing, became indisposed when she arrived in New York, and her husband comforted her with a refreshing breath of the outdoors by having brought to her room a tame deer.

Mme. Sakharoff and her husband Alexander, came to America to introduce their new dances, which had already astonished Europe.



© Hazel & Herbert

The bareback rider that recently created a sensation on New York's Broadway.

A Bareback Rider in a Broadway Café

A GRACEFUL bareback rider, poised on one foot with arms outstretched is a novel sight for a Broadway café, yet this is what the habitués at one of the sophisticated old resorts about town are still talking about.

Monkey and dog marriages no longer attract attention. The fad is no longer new, and those who indulge in fads are hard put when they want a new one. This is the first time such publicity has been gained through the love of blue-blooded horses.

The bareback rider created a great sensation along Broadway when it first was introduced by the creator of a new fad in evening wear at a well known restaurant. Visitors to the gay white way are still talking about it.

The picture of a painted figure on one's back is not so drastic an art as one that is tattooed. Pigment thinly applied is cheaper than the same amount of cloth, so the idea may be developed interestingly.



A machine for baling empty cement sacks. The machine compresses the sacks into a compact bundle, which can be shipped by rail or by express.

Bale Them for the Rebate

EMPTY cement-sacks bring a good rebate when carefully baled and shipped. To do the work by hand is laborious and time-consuming, but above is a simple machine for baling.

The empty sacks are laid across the baler, then a lever is pressed down to compress them into a compact bundle. Wires hold the sacks tightly and prevent losses such as would occur if the mass were loose. It is claimed that the machine is so inexpensive that the rebate on two bales of sacks pays the entire cost.

He Paints with His Toes

WHILE working in an airplane factory the boy in the picture lost both arms. He decided, optimistically, that since he still had his toes his case was not hopeless. He went to the Crailley Heritage Craft School and learned to paint pictures with them.

Here you see him working on a landscape. Men have learned to play on musical instruments, hold books, and even weave with their toes.



© Hazel & Herbert

Mme. Sakharoff while indisposed and confined to her bed, was comforted by having a tame deer brought to her room.



© From Illustrating Here too

This young man lost his arms in an airplane factory; undiscouraged, he learned to paint pictures with his toes.



It may be ugly, this baby hoatzin from British Guiana, but it's clever, it swims, dives, and flies

It's a Baby Hoatzin

BEHOLD a baby hoatzin! It was alone in the nest when the photographer approached. It climbed out bravely for the first time, and moved awkwardly to the end of the branch. The photographer followed.

When it was two feet away, the baby bird folded its wings and did a high dive into the water below. A few seconds later a scrawny head with two bright, beady eyes hopped up above the surface and watched the enemy closely.

When the photographer disappeared the exhausted hoatzin dragged itself out of the water and climbed back to its nest amid cheers and congratulations from its anxious parents.

It lives on the banks of the Berbere river, British Guiana.



The tool that trims the edges of the lawn has two blades—an upright curved one that does the cutting and a flat one that catches the pieces

A Trimmer for the Edges of the Lawn

REMOVING the rough edges has always been the hardest part of lawn-cutting. Two tools—a scuffle-hoe and a lawn-edger—have been necessary. But now Mr. Timothy Murphy, of Beacon, N. Y., comes along with a new tool that attends to the entire edging operation.

It consists of two sharp blades—one being flat on the ground and the other curved upward at an acute angle. The curved blade does the trimming and the flat one catches the grass as it falls.

But this flat blade has another job. It uproots any small clumps of grass that have grown just outside of the edge of the lawn. It is sharpened on three sides.



The "tensiometer" has been devised by the Bureau of Standards for testing the strain put upon airplane wires

Testing Airplane Wires

WHEN the pilot of an airplane cuts off his engine and starts downward, he can hear the vibration of the tautly drawn wires strung between the airplane wings. What is the strength demanded of these vital "thru-ns" which hold the frame of the airplane and keep it from being shattered?

The ingenuity of the Bureau of Standards has devised a means of knowing exactly what strain or tension a wire of a certain size can stand. The instrument is called a "tensiometer." It consists of two supports at a fixed distance apart, having a moving plunger midway between them. Two dials indicate what is happening when pressure is brought to bear upon the drawn wire, one dial showing the pounds of pressure and the other the wire tension.

Reading in Bed

DO you like to read in bed? Most people do, but they find that in a short time their arms grow tired from holding the book, and their eyes grow tired from reading in a bad light.

Both of these difficulties are done away with in the new light and book support that was recently invented by Christian Widmer, of Upland, Cal.

A lamp of a conical shape is mounted on an ordinary stand. Inside of the shade there is a lens that can be adjusted so that it will throw intense light on the book you are reading. The book is held in a rack fastened to waist and shoulders.

For Automobilists

THE picture below is for people who drive automobiles. This poor little fellow will endure this torture, without one minute's rest day or night, for five long weeks, just because a man driving a big touring car was not careful.

The child was hit. Both legs were broken above the knees. Here he is in a cot in a big Cincinnati hospital. Would you like to hear that pitiful cry and see him enduring this scientific torture, and know that you were the cause of it?

Science says this is the only way for the bones in his little legs to heal properly so that he will not be a cripple for life.



For the army of people who like to read in bed comes this contrivance to make them comfortable. It saves tired arms as well as eyes. Hands are needed only to turn pages.



This young sufferer is the victim of careless automobile driving. He will have to stay in this position for five long weeks. Surely that is a lesson for law-breaking speeders.

Barbers from Pole to Pole

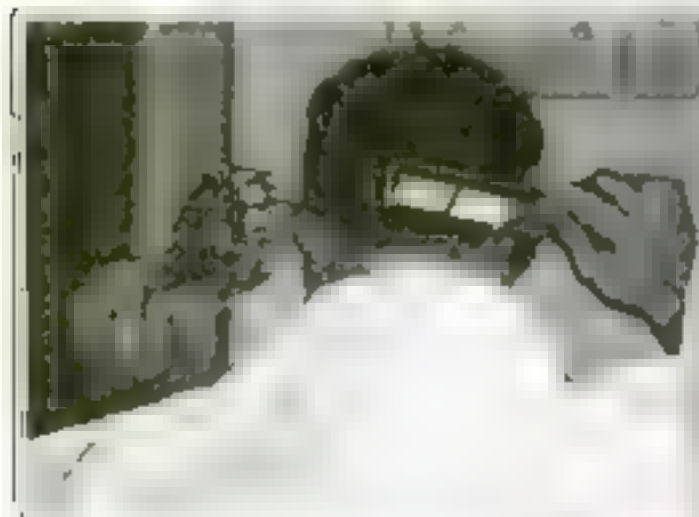


Men of the Arctic region shave each other with the same method as the Eskimo.



Barbering in the East.

Declares John K. ... that ...



This method ... with a few ...



How long does a hair ... and a ... and a ...? I presume you say Not at all, unless in the ... above. He is Mr. ... day ... together ... he ... in ... in ... of ... a ... in twenty ...

As ... of ... more ... at ... the ... or ... As yet there have been no ... and you will have to admit the superiority of the feminine touch



Barbering in the East.

No wonder he smiles so smugly! He has cut the hair of both the present Prince of Wales and the late King Edward

"We the People of the United States—"



The Alaskans pictured here live in a sod hut made of sod, and pay no rent to a landlord who may put them out because they have children

This Truck-Tractor Cuts a Road through Underbrush.

WHAT would a driver do with 60 horses and 7 wagons loaded with 42,000 pounds of wet clay, when he came face to face with a tangle of dense woods? His teams would refuse, as politely as teams can refuse, to budge a foot into the underbrush. But the driver of a combined truck and tractor puts on a spurt of gasoline and drives straight into the thicket; nor does the loose sand underneath the wheels interfere with his progress.

A truck combined with a tractor whose wheels work independently, constructed small enough to travel the narrow country roads and capable of making headway over loose sand, mud, or snow—when the front wheels are replaced by runners—is indeed a blessing to the farmer and the rural road-builder. It consumes two gallons of gasoline an hour in regular work under average conditions, or three fourths of a gallon of case oil (oil compressed from natural gas) in ten hours, and two gallons of cheap black oil a day are used on the traction wheels. This mechanical steed



Not only can the truck tractor easily haul eighteen tons of pig iron up an 11 per cent grade—but when a tract of heavy oak grub soil is to be broken, the tractor-truck goes right in and cuts furrows

does the work of sixty horses and does it better.

Naturally, when the tractor is busy in a rough field, or is digging its way through soft sand, its supply of fuel must be adequately provided without unnecessary interruption in the work.

Sixty gallons of gasoline can be carried in the truck, twenty gallons under the front seat and forty gallons in a tank in the rear. The driver makes use of a hand-pump to replenish the supply in the front tank when the fuel there is exhausted, the gasoline being taken from the rear tank. Speeds of 1½, 3, and 5½ miles an hour are provided, and when desired the tractor can reverse as easily as the old team would "back up" when the word was given.

Through dense jungle-like thickets in semi-tropical climates, or through the snowdrifts of the northern country, this tractor-truck will make headway. It is of particular advantage when hauling a train of sand-filled wagons across rough country in which a new road system is under construction.

Filling Cement Bags by Means of Suction

FILLING barrels or bags with cement or other fine powder is dusty work. The workmen try to protect themselves by wearing goggles and by screening mouth and nose with cheesecloth bandages, but these means of protection soon prove inadequate.

The accompanying pictures illustrate the method employed in one of the large cement mills in Germany for eliminating the dangers and discomforts caused by cement dust during the weighing and packing operations. The apparatus used automatically weighs and fills the cement.

When bags are to be filled, the empty sacks are fastened

with their open ends around circular frames supported by balanced beams inside of an iron case provided with an airtight door. When the door of the filling cabinet is closed, the constantly working suction pump exhausts the air in the cabinet, a valve is opened, and a stream of cement dust is sucked from the big tank through a tube which ends above the open end of the sack. When the cement in the bag has reached the desired weight, the sinking of the frame end of the scales opens a valve, admitting air to the case, as there is no more suction, the flow of cement ceases.

Barrels are filled in a similar manner.



When the door of the cabinet is closed, the air is exhausted and the cement sucked into the bag from the tanks.

By means of this apparatus barrels may be filled and weighed without causing a cloud of dust to endanger the health.

Why Does a Cat Have Whiskers?

Some startling conclusions on the subject

Your First Reader told you, in simple words and large type that pussy's whiskers wide as his body, were there to warn him of the size hole he could crawl through but that reason alone did not suit psychologists, and they have recently proved that whiskers aid the cat's eye



Why does a cat have whiskers? This question comes under the larger one—what is the function of eye appendages? Mr. P. P. Swindle has investigated this subject very thoroughly, and he has formed some startling conclusions, which he reports in the *American Journal of Psychology*.

Most animals have eye appendages that seem to obstruct their vision. And many of those that haven't any use substitutes—the snake, for instance, continually thrusts out its tongue. But, according to Mr. Swindle's investiga-

tions, these obstructing appendages really aid the eye. When an animal watches its prey or stares at a branch that it intends to land on, it wiggles its whiskers constantly and thereby rests its eyes. Thus, instead of becoming blurred in time, the object it watches is always sharply defined.

Mr. Swindle experimented with a tom-cat, watching him first with his whiskers on, and then watching him after the whiskers had been shaved off. Tommy soon changed from a fat, well fed cat to a thin, hungry one.



Though Tommy sits perfectly still and stares at the rat, he wiggles his whiskers constantly. Each wiggle rests his eyes and brings his visual power back to its normal sharpness. Stare fixedly at an object, and it soon blurs. Half close your eyes and it stands out again.

Tommy leaps and lands his victim. His eyecatch is kept sharp by the aid of his whiskers and he is consequently a fat, well fed cat.



But inquisitive psychologists shaved off Tommy's whiskers, and for the first time in his fat life he leaped and missed. In a few weeks he became melancholy and thin. Irritation whiskers were glued to his cheeks and his batting average improved perceptibly.



The squirrel and many other animals also need whiskers for expert vision. What is more, the squirrel's bushy tail, which he constantly swishes, helps his sight. Deprived of both whiskers and the hairs on his tail, he will often miss a branch when he leaps.



Put your pot on the burner, light the gas, and trust to the regulator to keep the Irish stew from boiling over.

It Keeps the Pot from Boiling Over

A gas regulator like the one shown in the photograph is a very useful household contrivance. It may be used on the slow gas pan on the stove, or the lady may devote herself to other work without being haunted by the fear that the pot may boil over or the food in the pan become scorched.

The regulator consists of a chamber closed by a flexible thin metal plate, and is connected by a thin copper tube with a capsule resting against the bottom of the pot or pan.

The capsule, the tube, and the regulator chamber are filled with a liquid, the expansion of which causes the membrane of the regulator chamber to bulge outward, thus partly closing the opening through which the gas is fed to the burner. The flow of gas is diminished until only enough gas is supplied to maintain a small flame.

An Invalid's Electric

NOT much larger than a tricycle is this new electrically propelled invalid's chair. It is so easy to drive that an invalid can manipulate it, and it goes so slowly that there is little chance of accident. The power lever is located on the right arm of the chair, and the speed is regulated by the back and forward movement of the lever.

The batteries that give the small electric its power are hidden beneath the seat. Up front there is a hood, but, since there is no engine and radiator, we fear that it is empty. Why have one at all? Perhaps for style, or for lunch.



The motor-driven rail saw at work cutting out a damaged section of rail. It saves taking out the whole section and sending it away to a repair shop, with the usual resulting delay.

Cutting Rails with a Motor-Driven Saw

"SEE that worn section of rail?" asked the section boss, pointing it out to the visitor.

Then he continued: "Just watch how quick a job we make of it!"

And in less time than one would guess the rail was made as good as new. How was it done?

Not, it is plain, by the old method, which was to have a gang of men take up the entire section of the rail and send it away to the repair shop to be sawed off, placed out, and welded—a job that generally used up valuable time.

The new way to handle the job is to use a portable motor-driven saw. Along comes the saw, and it neatly cuts off the bad part of the rail at any desired angle. A new piece of rail is cut to the proper length and welded in place, and the section of track is as good as new.

This saw may also be operated by hand if desired.



A notable sack of wool used as a seat for distinguished guests at an old London residence—reminder of early days.

A Woolsack in an Old London House

THE hall of an old London residence is a strange place for a sack of wool, but a very notable one may be seen at Stoke Park, Ipswich. The sack is five feet six inches long and three feet six inches wide, and is covered with crimson material which long since has become much faded. This woolsack has an interesting history.

The seat of the Lord Chancellor, in the House of Lords, is called the Woolsack because in the time of Edward III sacks of wool were placed for the members of the House to sit upon. The custom was really a subtle kind of lobbyism, the woolsack perpetually reminding the law-makers of England's staple trade.

The late Lord Gwydyr retained the woolsack here pictured as a memento of his early association with the House of Lords.

Seeing His Faults

IF a man can see his own faults he will soon correct them. That's why a mirror is placed alongside of each rowing-machine in the training quarters for students of the University of Pennsylvania.

The candidate for the crew knows just how a stroke should be made, and if his is wrong he will be able to correct it. The coach walks up and down, directing the men.

This method of training is quite different from the one used in most universities. The men usually row in a real boat that floats on real water. The coach stands near by and gives directions.



This invalid's chair is driven by electricity; the occupant turns on the power by moving a lever on one of the arms.



He watches his rowing motions in a looking-glass and thus he is able to correct the faults that he sees in his stroke.



Flies hover around garbage-pails, so why not set your fly-trap on the garbage-pail's lid and capture them?

Where the Fly-Catcher Will Do Most Good

FLIES always sit around food. They're not very particular about what they eat, and generally they make the garbage-can their headquarters.

John E. Connolly, of Racine, Wis., noticed this and decided that the best way to round up the pests was to set a trap for them near their favorite hang-out. And so he invented a new fly-trap that fits on top of the garbage-can's lid.

It is a wire-screen cage in the shape of a cone, and has a central tube leading down to the knob on the lid. At the bottom of the cage, resting on the lid of the pail, is a pan filled with fly poison.

Helmets Made to Order

AVIATORS' helmets like that pictured below are so carefully made that a plaster cast of the airman's head is necessary. To achieve the utmost in telephony in the air the conditions must be made noiseless. The roar of the airplane propeller, the molian tunes played on the tense wires, all tend to drown out the faint sounds in the receiver, which may be of the utmost importance, messages from some point miles away.

Mr. C. W. Birch, an industrial engineer of Los Angeles, has invented a double helmet which closely fits the aviator's head. It is made of felt to deaden the sound from outside sources, and over it fits another helmet into which the telephone wires are fixed. An air-space separates the two helmets, and the telephone receivers are attached through a slit in the inner hat.



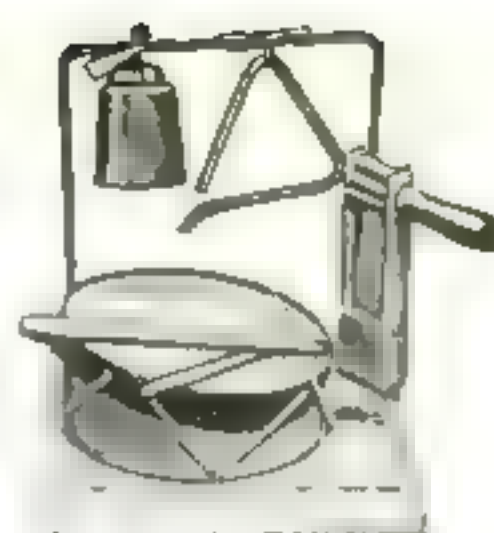
A homemade bomb. It had no cap and so it didn't go off. The villain made it out of old clothes, burlap, rope, dynamite, nails, black powder, and an unknown oily substance.

A Bomb Made of Burlap and Old Clothes

IN the dead of night the black-hander lit the fuse and threw a bomb in Tony Perino's front yard. Was he killed? Oh, no; the bomb was a homemade one, and the villain had forgotten to put a cap on it.

He made it out of old clothes, burlap, rope, and, in the center, four pounds of dynamite, half a pound of nails, some unknown oily substance, and a quantity of black powder.

He also attached a twelve-foot fuse to it. The fuse burned down to within a few feet of the bomb and sputtered out. Even if it had burned to the end, the absence of a cap would have prevented an explosion.



If you like jazz, buy a jazz outfit, with it you can make all sorts of weird noises in the name of music.

Get a Little Jazz Band for Your Family

WHY not have a little jazz band in your home? Manufacturers have met this need, and a complete jazz outfit, including a cow-bell, a triangle, a drum, and several other equally effective noise-makers, can now be bought in many novelty stores.

All of the jazz instruments are small and you can keep them on top of your piano ready for instant need.

We are told that "for parties, masquerades, and the like, a home jazz outfit is the proper thing." Be that as it may, it is at least a noisy thing and will drown any bad notes that the jaxxing pianist may strike.

Hypnotizing a 'Gator

"EVER hypnotize a chicken? or a cat? or a snake?" asked the inquisitive one.

"No, I haven't," is the reply. "But if you'll just step out here in the back yard I'll show you what I can hypnotize."

Out there in the yard is a young alligator. Of course, he's planted there fresh from the enclosure where they keep alligators at the zoo.

Then the process of hypnotism begins. The young 'gator is switched over on his back and a firm hold obtained so he cannot escape before he is brought under the influence of the hypnotizer.

The demonstrator then begins to rub the under side of the alligator's throat. If an old crusty specimen were at hand, great care might be required not to tickle him; but the young alligator merely goes to sleep.



At the left is held a plaster cast of the aviator's head, and at the right the inner helmet of felt; it is through the slit in the hat that the telephone receivers are attached.



Petting the animal under the chin while he lies on his back makes him fall asleep. This is a youngster, the job is not so easy when old alligators are to be hypnotized.

Scarecrow to Us, God to the Indians

NOT all gods are beautiful. Visit the Canadian Indians of a certain section, and one of the most conspicuous objects to be seen in the fields will be what at first sight seems to be a scarecrow. But it is nothing of the sort—it's an Indian god.

In the middle of the large plain is a bundle of old clothes draped about a stout pole. A knitted hood, surmounted by a flabby hat, adorns the faceless head. A muffler is tied around the neck. Plenty of extra clothing is piled around the feet on the ground. Tin pans of liquid refreshment and food are placed near by.

So terrible a god must be kept in good humor; hence the solicitude for its welfare.



An Indian god surrounded by food, drink and clothing. It looks like a first-class scarecrow.

A Huge Fishing-Pot

THE making of fishing-nets is one of the industries of British New Guinea, and the strange dark people of these Pacific Islands are adepts in both the making and handling of remarkable fishing-traps. Like a gigantic hornet's nest, or like a mysterious conical basket which might enclose a bottle of the choicest vintage, these fish-traps are constructed.

Strips of black cane five feet in length are used in making these "fishing-pots," as they are called. The traps are used in the swamps to catch small swamp fish, and are thus closely matted to hold the catch.

It is a custom in the Girar tribe for the married women to wear head-masks, though they are not so particular about covering the rest of the body.



These dogs pull their cart out the deep water where it fills itself.

Water by Dog-Power

INDIANS in some parts of Canada have a strong prejudice against using the water near the shore of a lake for drinking, and an equally strong prejudice against using the water for drinking a supply for a long distance. The problem is solved by the use of a rude water-cart drawn by dogs.

The dogs are trained to draw the cart out into the deep water, where it fills itself, and then to pull it to shore under the direction of the owner.



This inhaler works automatically to enable the wearer to breathe only fresh air that is medicated to kill the germs.

A New Nose-Mask that Filters Out the Germs

A NEW type of inhaler strapped over the nose presents the formidable aspect of a gas-mask, but its working principle is applied forcibly in the war on disease.

This inhaler has two rubber valves, which work automatically. One of the valves permits the inhalation of fresh air, which is medicated and filtered in the inhaler. The other valve permits the exhalation of the gases that are generated in the process of breathing. It is only necessary to insert the remedy, strap on the inhaler, and just breathe naturally.



This married lady keeps her face covered, she also keeps a hand on the gigantic fish-trap.

What Calorene Gas Does

ALCOHOL, the great unloved, has done at least one good deed for the world. It is supplying us with calorene, a new cutting gas that is not unlike acetylene.

Professor A. S. Kinsey, of the Stevens Institute of Technology, was the first one to develop this gas. The high ratio of its carbon content to its hydrogen content is largely responsible for its fine cutting qualities. An analysis of it shows carbon, eighty-six per cent, and hydrogen, fourteen per cent.

Acetylene gives a maximum temperature of sixty-three hundred degrees Fahrenheit, and the new gas gives sixty-two hundred. Calorene may be compressed and stored in cylinders.

Most cutting gases leave an oxide coating on the metal that is very hard to remove. But the coating left by the new gas is thin and fragile, and does no harm to the metal below.



The oxide scale that calorene leaves on the metal being cut is easily removed.



© Studio A. Fisher

This little "movie" star has a pair of shoes for each day of the month

Thirty Pairs! She Must Be a Millionaire

ONE person in the world, Beanie Harrison, a moving-picture actress, has thirty active pairs of shoes—one for each day of the month. This proves two things: first, that the "fabulous" salaries paid to movie stars are not fabulous at all, but very real. Thirty times twenty (let's say) equals six hundred. Why, six hundred dollars is more money than many a hard-working school-teacher earns in a year!

The second point is that moving-picture stars don't practice what they preach. Was it not this same actress who starred in a play called "Shoes"? In the play she sinks to the depths for the sake of a much-needed pair of shoes.

The Complexion that Won't Come Off

THE complexion that won't come off is being administered to the girl in the picture below. Her beauty doctor uses an electric tattooing needle: he tucks pink pigment under her skin that perfume will neither rub off, wash off, nor fade away.

These questions naturally arise. Will it harm her skin and prevent proper respiration? When the outer skin wears off, what will happen to the pigment?

Ask any man who has gone through life tattooed and he will be able to answer the questions for you.



© C. A.

A beauty doctor is tattooing this girl's cheeks with pink pigment



In China you must rely on traveling barbers for a hair-cut, it's a case of luck

In China the Barber Comes to You

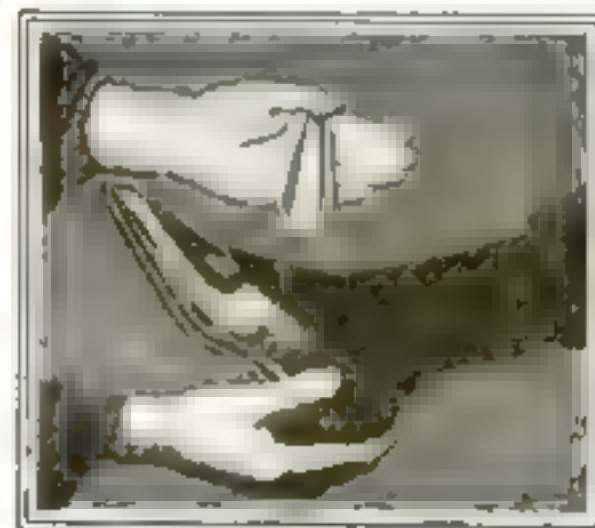
YOU can never be sure of getting a hair-cut in China. Barbers in that land have a taste for travel, and they carry on their business in a little shop on wheels.

The matter of a hair-cut, therefore, is left to fate, which comes when the traveling barber gets around your way. The man in the picture above was very fortunate. He met a barber when his hair was only a few inches long all around.

Hooking the Shoe-Horn

"HANG it! What's the matter with this shoe-horn?" one is apt to exclaim when using an ordinary shoe-horn; for these supposedly useful little instruments are often annoying to the last degree when they slip between one's fingers while trying to pull on an unruly shoe. Too, the horn monopolizes the use of one hand entirely for itself while pulling on the shoe.

Now we have a shoe-horn with a hook at the end to fit over the finger and prevent the horn from slipping. This new horn is distinctly an advantage to the shoe clerk, for he can use both hands in fitting the customer's shoe, while at the same time making use of the horn.



The simple extension at the end of this shoe-horn enables one to pull on the shoe without the annoyance of having the horn slip out of the hand



Photograph by George H. H. H. H.

A direct result of General Gomez' experiments in cross-breeding zebu and American cattle is the increase of the milk intake at the model dairy at Maracay. The butter, cheese, condensed milk, and other products are shipped to all parts of the country.

An Interesting Experiment in Hybridization

FROM eastern Africa to Trinidad, and from there to the estate of General Juan Vincent Gomez, the president-elect of Venezuela, the zebu has gone to find himself the subject of a remarkable experiment; for the distinguished general is one of the world's greatest cattle-raisers.

In the cross-breeding of zebu bulls with Holstein-Friesian, Hereford, Jersey, and other pure-blooded stock imported from the United States, a remarkable hybrid

cow has been produced. It is slightly larger than the northern cow, and it lacks the hump of the zebu.

The milk production of the hybrid has been found to be very much greater than that of the northern cow, especially when it is raised in the tropics. The yield of beef is also better in quality and quantity. What is of great importance, also, the hybrid is immune to the tick and to the organic diseases to which domestic cattle are subject in the tropics.

The Size of This Valve Is Easily Gaged by the Human Element

IMAGINE a valve so large that twenty-four people can look out of the opening into the great cylinder that forms the main chamber of the "shut-off" arrangement—for the valve is called a "shut-off" valve and is used on large piping systems.

The height of the cylinder, as scaled from the size of the figures, is about fourteen feet, while, estimating the width in the same way, it is considerably more than seven feet in diameter.

Compare this great valve with one of the smallest, the kind commonly employed on the steam radiator in one's room. Though of a totally different type, this is an escape valve which permits the air to pass out of the pipes when the steam is turned on. The little valve on the service pipe, which enables one to cut off the water in an emergency, is a miniature "shut-off" compared with the huge valve into which a crowd of twenty-four young men can stretch out at full length without discomfort.



A gigantic shut-off valve, inside of which there is room for twenty-four boys to stretch out full length on the "shelves."

© Kappel & Hirstert

Pick up bricks ten at a time! A bar is adusted across the row of bricks, by lifting the handle the bricks are tightly clamped.



Reducing a Brick-Pile with Speed

LOADING bricks takes time when each brick must be handled separately. Perhaps thousands of men handling bricks were contented to go on handling them out singly or in pairs, until one day along came a man with an idea.

What a laborious way to pass bricks! and he immediately found a quicker way.

A brick-tong, capable of lifting ten bricks at a time was the result. One has merely to adjust it for the number of bricks to be carried, set it down so the ends project over the row of bricks, pick up the handle, and the mass can be lifted easily.

The principle upon which the tong works is that of a curved lever over the handle when raised serving to clamp against the brick at the lever end of a horizontal bar.

Beer labels are worth more than Austrian bank notes, so a Swiss brewer pasters notes on his bottles.

© Kappel & Hirstert



Austrian Banknotes Make Good Beer Labels

BEHOLD—a bottle of beer! Alas, it is not for you, but for some lucky Swiss. And look at the label—an Austrian banknote! In fact, the brewer of this glorious liquor puts Austrian banknotes on all his bottles. And he is not, as might be thought, rash and extravagant, but most economical.

The brewer's name is Krone, and the same word appears in large black type on the note. An Austrian Krone is worth less than a cent, a label more than a cent. Hence Krone uses Kronen.



The electric retouching pencil guided over the transparent negative—the retoucher's efficiency is doubled.

Retouching by Electricity

"WHAT an ideal likeness," remarks a friend. The prints from the latest negative are retouched so that all of the natural defects are missing.

Ordinary negatives often contain minute blemishes caused by very small particles collecting on the film during development. Then, there may be wrinkles on the subject's face which show up strongly as dark lines in the print. A dark spot or line in the photographic print is a transparent line or spot in the negative, and opaque material is necessary to touch out these defects on the negative to make them invisible when printed.

The old way of retouching was for the photographer to make the touch across the negative, at times stepping out all of the undesired transparent spots.

The new way is for him to make use of an electric pencil. The electric current causes the lead of the pencil to vibrate up and down, thus automatically doing the stepping while the retoucher simply guides the pencil over the negative.



© Wood and Film Service

A horse standing patiently on a roof? Just the advertising scheme of an enterprising owner of a stable.

Fresh Air for a City Horse

WHY do they keep a horse on the roof? Passengers on the elevated trains in Brooklyn are asking one another when they look out of the windows and see a large white horse standing near the edge of a flat roof.

One with sufficient curiosity, who asks the question of the man who runs the livery stable downstairs beneath the remarkable roof-ground of the white horse, learns that the animal is kept there merely as an advertisement.

You see, it is an artificial animal, the famous Wooden Horse of Brooklyn.

Heating Metals in a Self-Regulating Electric Melting-Pot



International Film Service

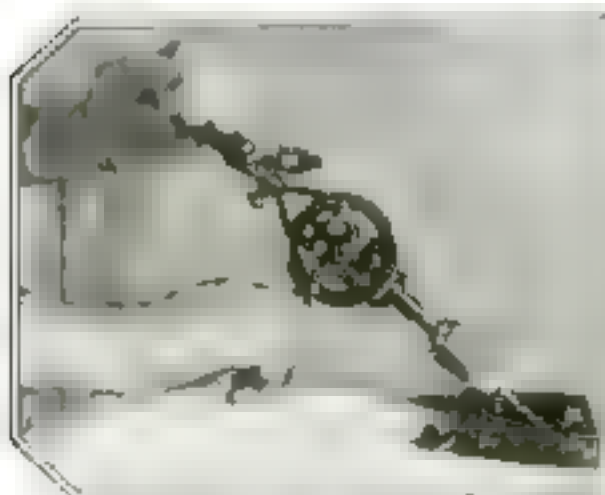
Two receivers double your hearing power. Combined with the transmitter, the instrument is found very easy to handle.

Put Both Ears on the Wire and Double Your Hearing

"HELLO, hello—I can't hear you!" So saying, you put your finger in your exposed ear and try to shut out the noises around you.

Your telephone ear works at cross-purposes with your other one. But if you used a double receiver like the one above both ears would be listening to the same thing at the same time and your hearing power would be doubled. Receivers and transmitter are combined in one instrument that fits in a hollow telephone-stand. Thus with one hand you could operate both.

Men like the new receiver, but girls don't. It interferes with the great puffs of hair they wear over their ears.



A protractor level attached to the handle of a drill to work at an angle.

Drilling at an Angle

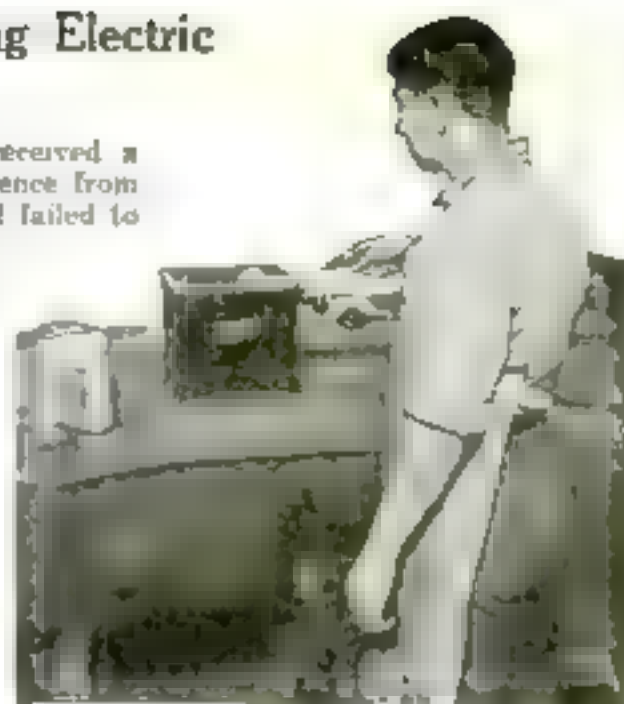
TO drill a hole at a certain angle, there is an arrangement by which it can be done with an electric or hand drill. A protractor and a small spirit-level furnish the means.

The level is set at the desired angle as indicated by the protractor, and the drill brought to the angle necessary to make the level stand at zero—or "level." If the hand is as steady as it should be, the angle of position can be maintained until the hole is started, and after that the matter becomes easy.

EVERY metal-worker has probably received a jolt, on returning after a brief absence from his melting-pot, to discover that he had failed to turn down the gasoline torch under the melting-pot to prevent too high a degree of temperature being raised. Not only was the lead burned, but the heat from the overheated apparatus had set the near-by woodwork afire. He resolved this should not occur again. So the next time he was careful to turn down the flame of the torch when he expected to return in a few minutes. This settled into a temperature too low to keep the metal in a molten state, and time was lost in reheating it.

But now there is no need for such inconvenience. The metal-worker can leave his melting-pot unmolested for any interval if he uses an electric self-regulating melting-pot.

It looks like a square box supported by short legs, and is fitted to be connected with any electric circuit. The container into which the metal is placed is surrounded by a coil that is insulated to prevent radiation of temperature wasted on the outside, and to heat the container evenly on the inside. Its remarkable feature is the self-regulation of its own temperature. The wire that is used offers increasing resistance to the current as its temperature rises, fixing a maximum limit at 765° F.



Turn on the current and this melting-pot will control its own temperature so that a maximum of 765 degrees is not passed. The self-regulating melting-pot weighs only twenty-five pounds.

Puss in a Bundle



Hal E. Barker

Wrapped in a paper cornucopia, pussy is an easy bundle to carry around.

MARY has a little cat; his hair is white as snow. Everywhere that Mary goes, the cat is sure to go. He doesn't trot along behind her, either. She carries him in a paper cornucopia.

Only his head peeps out, and from the sleepy expression on his face it would seem that he rather likes being wrapped up like ten cents' worth of cinnamon. With no stray feet, claws, and tail to worry about, his mistress finds him easy to carry.



The new asphalt iron has a kerosene-burner inside. Almost like ironing a shirt, the workman passes the hot iron over the asphalt and heats it.

A Self-Heating Smoothing-Iron for Asphalt Pavement

BELCHING forth a cloud of smoke and filling the air with ashes, the wood-fire wagon comes down the street. Workmen carry the irons from the fire to the asphalt spread on the street, and much of the heat is lost in transit. Time is also taken up in the process, so that the old way of heating the asphalt is inefficient in economy.

Now there is an iron that saves from 60 to 75 per cent of fuel cost. It does the work of three men, and does away entirely with the smoky wood fire. The asphalt smoothing-iron has a heating chamber within, supplied with a 1-gallon oil-tank equipped with a hand pump and a kerosene-burner. The burner is so arranged that the compressed air forces the flame directly into the iron.

Light the flame in the burner and pass the iron forward over the asphalt, and it will immediately become heated to just the right temperature to permit the street-paving job being finished at one fifth the cost of the old method.

Do It with Tools and Machinery



This kind of "dog" does not need a wrench to operate it. It simply opens, slips over the work and the cam jaw closes automatically. It is made in five sizes.

The die-head is automatically opened as soon as the travel of the turret is stopped, or the head can be opened at any point by retarding the travel of the turret slide by manipulating the handle.



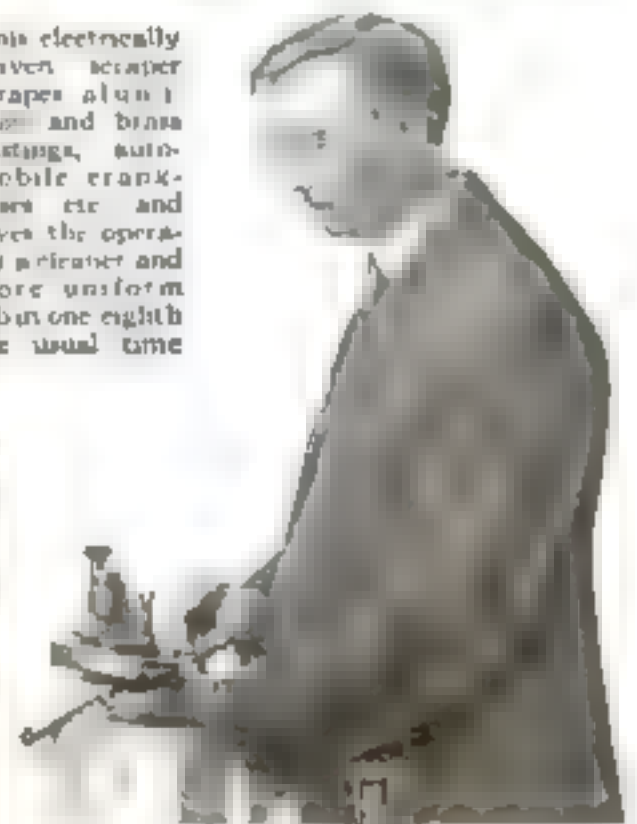
For metal working machines comes a simple attachment that automatically opens and closes the workholder during the feeding and retrograde movements of the tool.



Winding armatures of electric motors is a long and tedious job when done by hand. Here is a specially designed motor driven machine for doing the work easily.



This electrically driven scraper scrapes aluminum and brass castings, automobile crank-cases etc. and gives the operator precision and more uniform job in one eighth the usual time.



This apparatus includes an attachment for holding and feeding tool bits against the grinding wheel. The method eliminates the elapsed hand-grinding way, which gives an unsatisfactory edge.



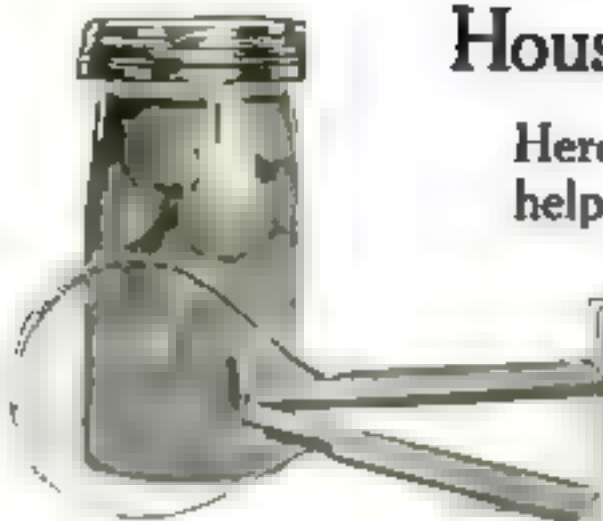
About all that could be demanded of a sand mill is embodied in this small motor-driven machine. A perfect whirlwind of sand comes out at the bottom when the operator scoops in a supply at the top.

This 'both ways' planing tool permits a roughing cut to be taken on the outward or slower stroke and a finishing cut on the return or fast stroke. Double efficiency.



Housekeeping Made Easy

Here are some new machines that help promote household efficiency



It clamps around the preserve-jar cover and loosens it without trouble



© Hazel A. Horton

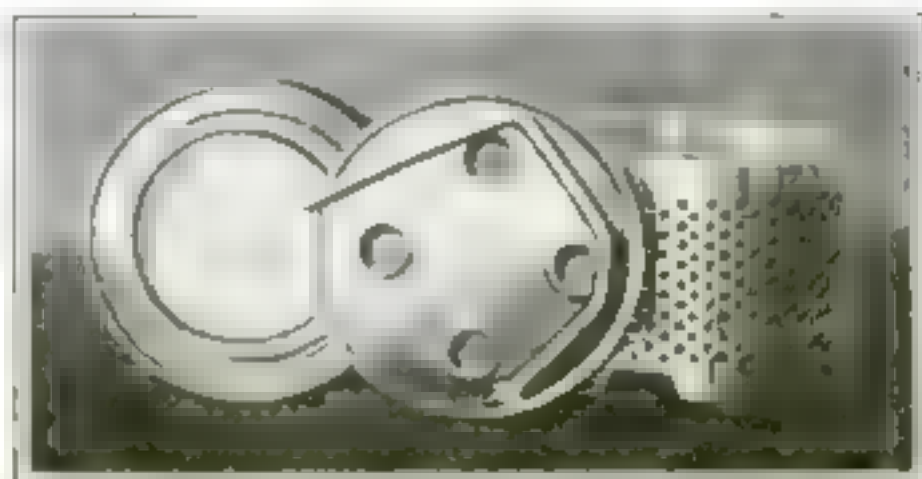
An electric light on your vacuum cleaner shows up the dark places under beds and in corners. The attachment can be made by any amateur electrician



Press down this can-puncturer and presto! the can has two holes in it through which the ingredients flow out



This electrical water heater straps around the tank and is protected by a cover that latches over the heating pad



A new fumigator has four candles in place of one. It does much better work than the single-wicked kind and if one candle should go out the others will still work



A thermometer especially designed for immersing in cooking liquids, such as jellies and the like, is a useful new kitchen utensil



Sprinkling the clothes on the line by means of a hose is a much better way than the old hand method, and they can be placed in the basket at once, all ready for ironing



This new cake mold bakes the cake full of holes—do holes render cake more edible?

Here is a cooker that steam-cooks the food. It cannot burn out, and no heating is required. A tight cover which carries a pressure-gage, clamps down tightly upon the kettle

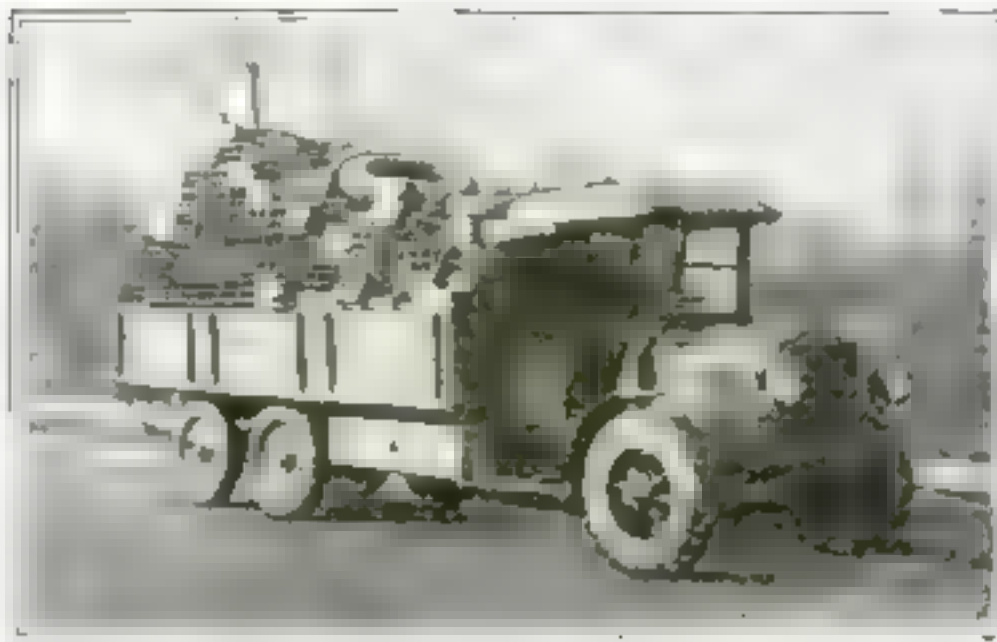


Solving the Heavy Truck Load Problem

SINCE tire cost and weight are perhaps the greatest factors of interest to truck-owners, it will be interesting to note that instead of using the giant 48 by 12 pneumatics, weighing 398 pounds each, on the rear of five-ton trucks, the tandem axle construction embodied in the new six-wheeled truck allows the use of four 40 by 8 pneumatic tires, weighing 119 pounds each—a reduction of 279 pounds in the weight the driver on tire changes will have to lift. In addition, the four smaller pneumatics cost one third less than the larger tires.

As the same size of tire is used all around on the truck, the eight-inch tire can also be used as a front wheel spare, still further reducing the tire investment and the number of spares necessary to insure continuous operation.

No more appealing feature can be found for municipalities than that of road-saving demonstrated by the pneu-



Increased ease in handling is one of this six-wheeled truck's most prominent features. Greater braking capacity is also obtained by its construction, four brakes being used instead of two.

matic-equipped "six-wheeler." The average road has the maximum base practicable, and begins to disintegrate under the excessive pounding of solid tires. With the truck weight distributed on four rear wheels, road and truck engineers estimate that the average road will withstand a load up to seven tons under newly developed construction, with no more destructive

effect than that resulting from the three-and-a-half-ton load on two rear solid tires. Road-saving has a tremendous popular appeal, so that such a quality in the new type would not only offset unfavorable sentiment against the use of highways by heavy vehicles, but would also be a great stimulus to larger appropriations for road improvements.

One striking advantage of pneumatics on the tandem axle construction is that they permit a far greater operating radius and steadier riding qualities.

The six-wheeler seems to cling to the road, and rides so steadily and with so little vibration that, in an experiment where a glass filled with liquid to within an inch of the top was placed on the rear of the truck, none of the water was spilled, even when the vehicle traveled over rough roads. In passing over an obstruction, the chassis rises but half the distance it would in the usual type of construction, and by reducing shocks and vibration proves possession of exceptional riding qualities.

In some recent hauling tests between Akron and Cleveland, such cushioning effect was produced by the smaller pneumatics and the multiple-wheel construction that with a five-ton load the truck traveled 48.6 miles at an average speed of 26 miles an hour, and registered eight miles an hour average speed in heavy traffic while coming out of Cleveland.

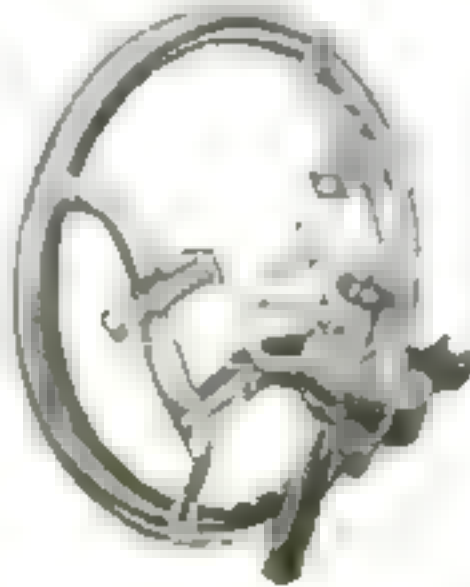
The Tilting Steering-Wheel that also Locks

AUTOMOBILE steering-wheels that may be tilted to give the driver more space to get into or out of his car are not new. Neither are steering-wheels that may be locked. But a wheel combining both of these features is brand-new.

This steering-wheel is made in two models, one for Ford cars and one for other makes. In principle, the models differ only in the size and elaborateness of the wheel. It has been approved by the National Board of Insurance Underwriters, which allows a rebate on theft insurance if it is installed.

The double or upward and downward tilting action of the wheel is secured by mounting it on a four-point spider in which the two front spiders serve as the anchor when the wheel is to be tilted forward through a small arc or backward and downward through a greater arc. The Ford wheel tilts forward only.

Because the wheel always remains permanently pivoted to the two front supports, it cannot be driven off the top of the shaft to permit of fitting another wheel in order to control the action of the front wheels necessary to drive or tow the car from its position.



The plunger lock in this tilting steering-wheel allows the wheel to be turned freely about the top of the steering column, no matter whether the car wheels are turned straight ahead or canted into the curb at an angle.

At Last—a Real Mirror for the Automobile

IF you have ever had a near accident on account of a law-breaking speeder coming up on the right side of your car when your fender mirror was placed on the left side, you will appreciate the value of the new type of

rear vision indicator shown in the accompanying illustration. This mirror is placed in the center of the windshield at the top, and gives a clear view of everything to the rear on both sides of the road.

The speedscope, as it is called, has adjustable bracket arms attachable to any car. When mounted on a closed-body car, rear vision is obtained through the rear top window.



You don't have to stretch your neck to peep into this mirror located at the top of the windshield, it is easily accessible.

\$633,000,000 for Highways

But first the government is measuring automobile impact on roads

THE United States government is planning this year to spend \$633,000,000 in building permanent highways. Owing to the vastly increasing use of the motor-truck and automobile, the road problem has become of great importance. Heavy loads at rest on the road surface exert but little effect, except where the surface is too soft to bear the load. A wheel load of 8,500 pounds at rest on an eight-inch concrete slab on a rather wet clay subgrade exerts a fiber stress in tension of only 34 pounds to the square inch directly under the load, as compared with the modulus of rupture for the average concrete road surface, which ranges from 400 to 800 pounds a square inch. Hence the only danger of serious injury to the concrete from loads at rest occurs at the corners of the slabs.

Impact is a frequent cause of road failure, and, with a view to ascertaining everything possible concerning the impacts exerted by various kinds and sizes of motor-trucks operated under different conditions, the United States Bureau of Public Roads is conducting some very interesting experiments.

The scheme in use is to deliver the impact of a moving truck to a small copper cylinder, the blow deforming the cylinder to a definite amount, depending on its intensity. A concrete pit is constructed in the track of the motor wheels, and a hydraulic jack is placed in the pit. The plunger of the jack is enlarged at the top with a platform of suitable size for receiving the blow of one wheel of the truck. The copper cylinder that measures the blow is set directly under the plunger of the jack, the impact being transmitted through the plunger to the copper cylinder. The copper cylinders are each turned from half-inch copper rod, and are half an inch in length, being heated and standardized so as to be absolutely uniform in

physical characteristics before being used in impact-testing work. The impact deforming the copper cylinder is then compared with the impact from a resting load necessary to deform it to the same amount.

Impact is measured in different ways, the truck in motion being caused to fall through different heights before striking the plunger of the jack. The truck is also made to strike obstructions of different heights

placed directly on the plunger of the jack. Different sizes and makes of trucks, operated at different speeds and using solid rubber or pneumatic tires, have been tested out to ascertain the impacts they deliver.

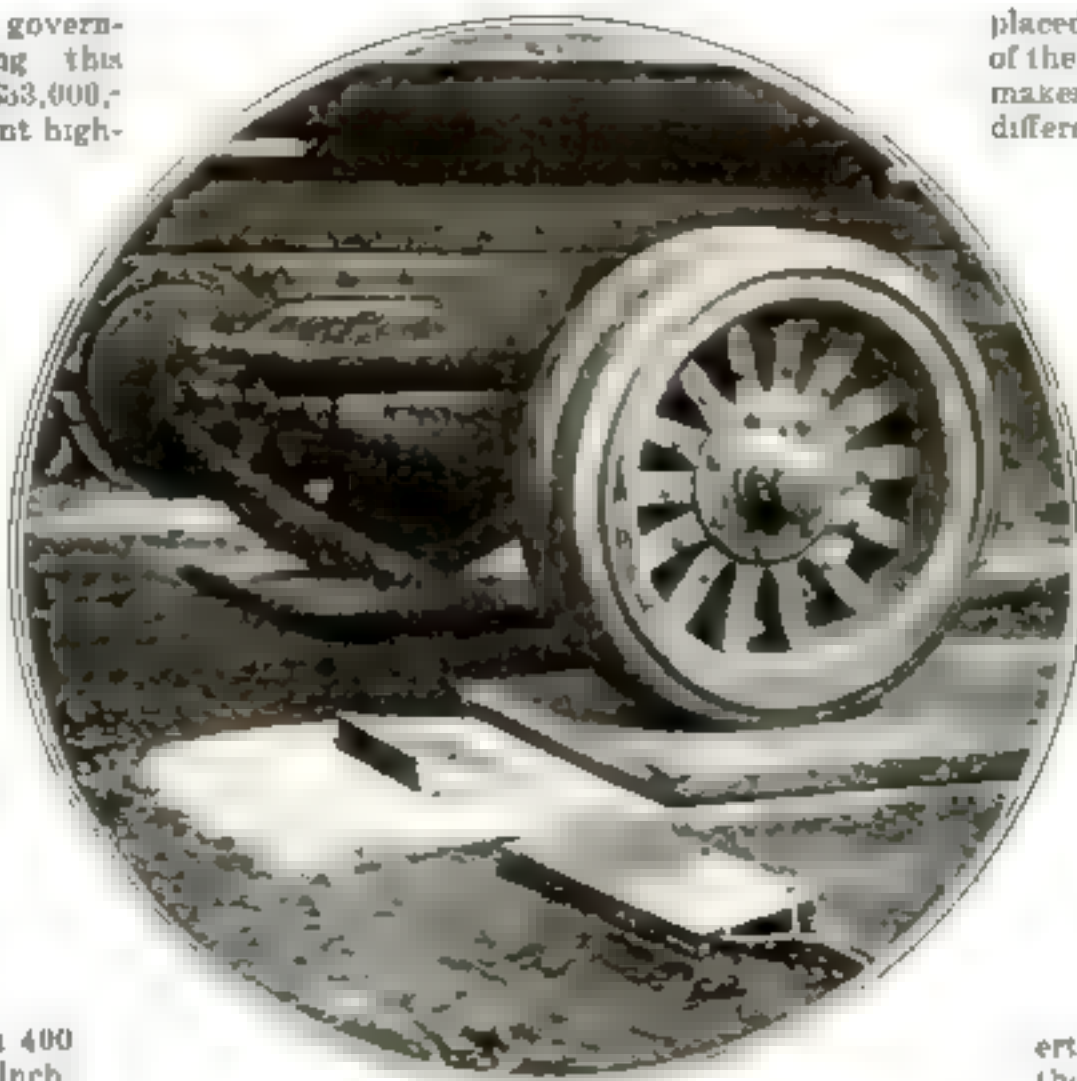
A standard three-to five-ton army truck loaded with five tons of sand, having a total weight of 7,750 pounds on one rear wheel and an unsprung weight (that is, not absorbed or broken by springs) of 1,837 pounds on one rear wheel, operated at a speed of fifteen miles an hour and falling through a distance of three inches, exerted a maximum impact pressure of 42,000 pounds, which was 5.4 times as great as the pressure ex-

erted by a rear wheel when the truck was at rest. When the truck, running at a similar speed, dropped from a height of only half an inch, the impact pressure produced was 28,000 pounds, or 3.6 times the static load pressure.

This indicates that the higher the fall, the greater is the amount of impact pressure, and also shows that trucks with great unsprung weight produce high impact pressures. Similar tests, in which the rear wheel of the truck was forced to strike an obstruction, showed that the impact pressure increased with the velocity and with the height of the obstruction.

Wedge-shaped blocks were also placed on top of the plunger of the jack and the truck driven over them, with the consequence that the impact pressure always increased with the angle of inclination of the block and the speed of the truck. These conditions are duplicated in actual road travel when the truck rolls into a depression of the road.

All of these results will be considered in the future in designing and constructing federal highways, which, as far as possible, will be built to withstand the impact pressures of the heavy traffic that passes over them.



This concrete pit, with a hydraulic jack and copper cylinder, measures the impact of the blow from the truck wheel passing over it

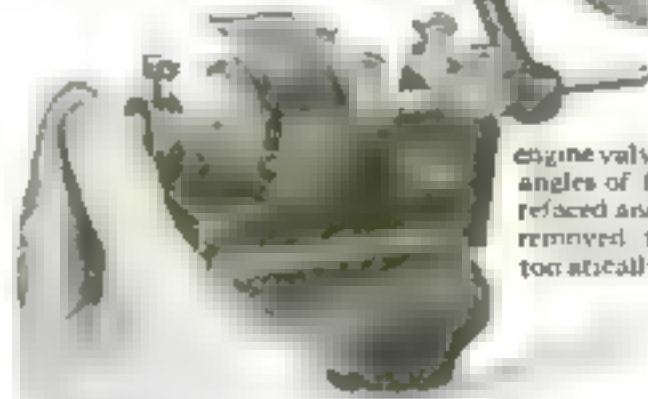


The copper cylinder that measures the blow is set directly under the plunger of the jack the impact being transmitted through the plunger to the copper cylinder

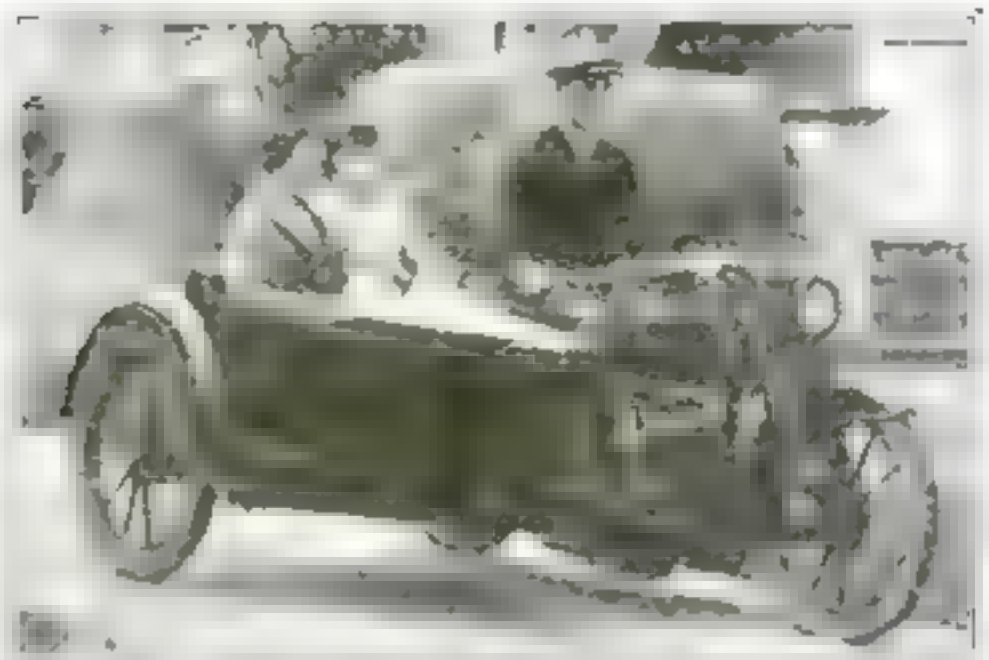
There's Always Something New



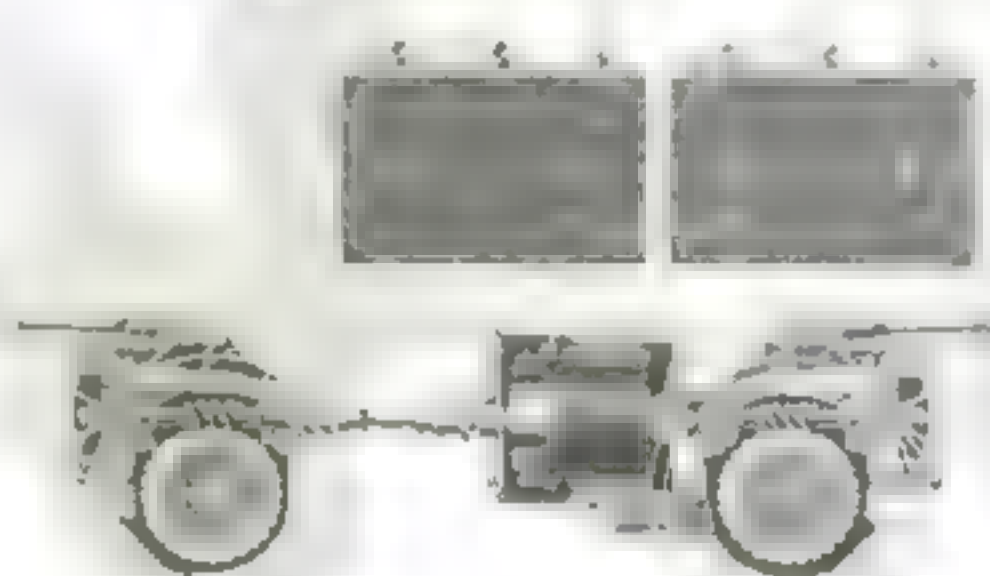
The safety indicator has an electric light to illuminate street names painted on the curved glass inserts



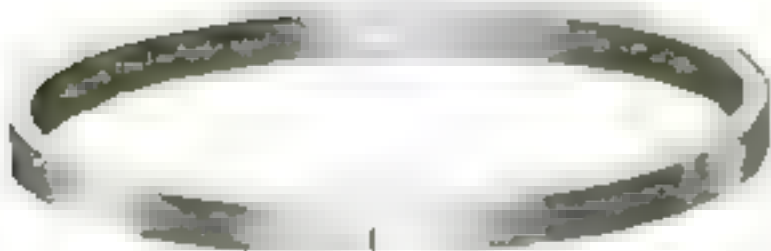
With this simple tool, engine valves with different angles of face are readily refaced and all carbon pits removed. The valve is automatically self-centered when it is put in the holder of the apparatus



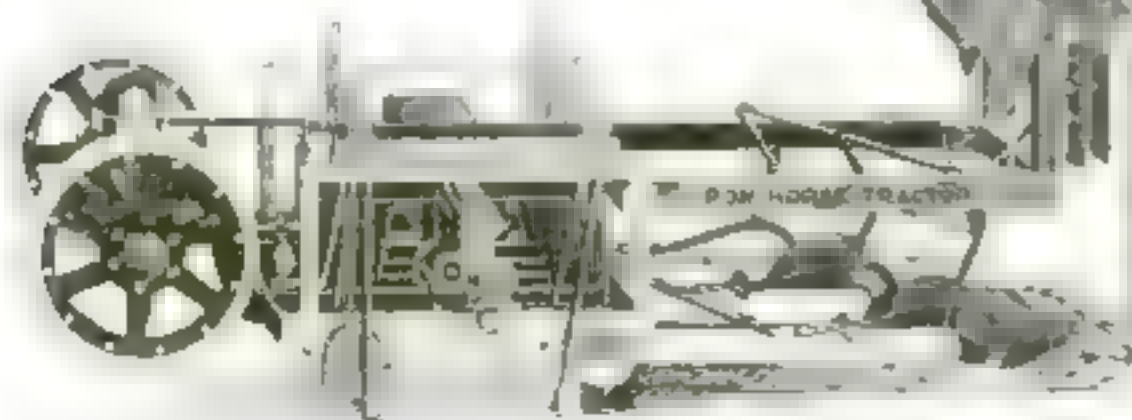
Here is a machine that is built like a motorcycle and drives like an automobile. It claims riding qualities equal to the best automobiles



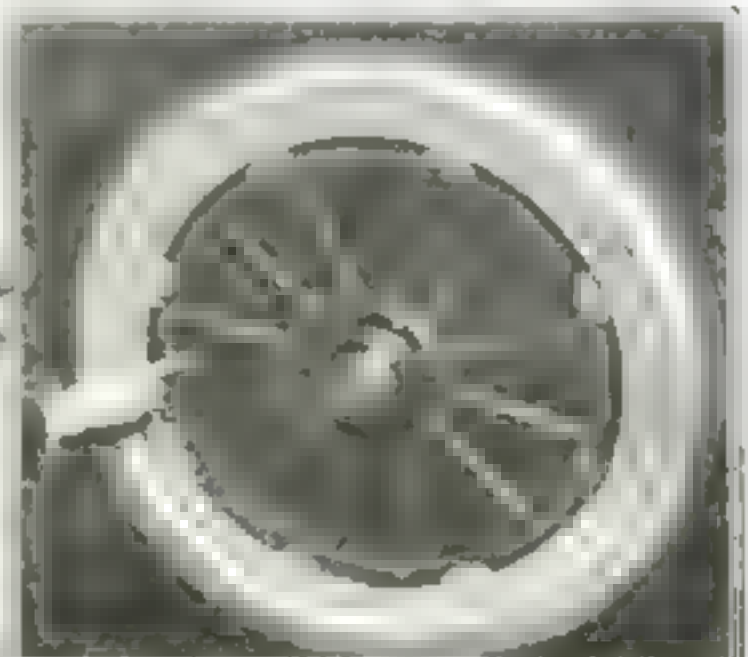
The phantom view of this electric tractor shows the four wheel drive and side units. Universal joints and propeller shaft connect the two with the motor



A new type of ring, with attention to the shape of the surfaces at each end of the ring



By a series of multiple units or legs, this tractor walks on the soil without tearing it by cleats or packing it tight by huge flat wheels. It is also equipped with rubber-tired wheels, which transform it into a farm truck, thus making the tractor serve a dual purpose

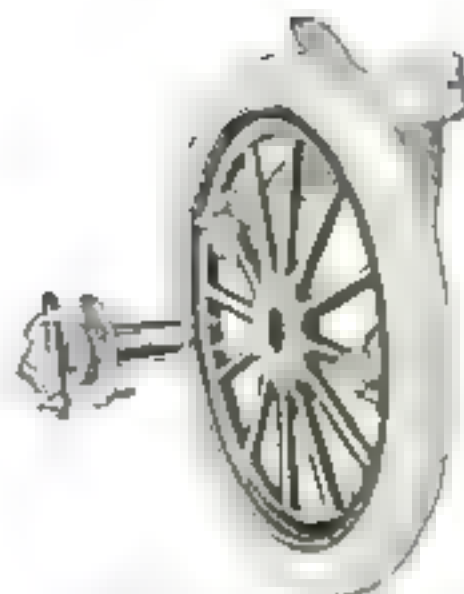
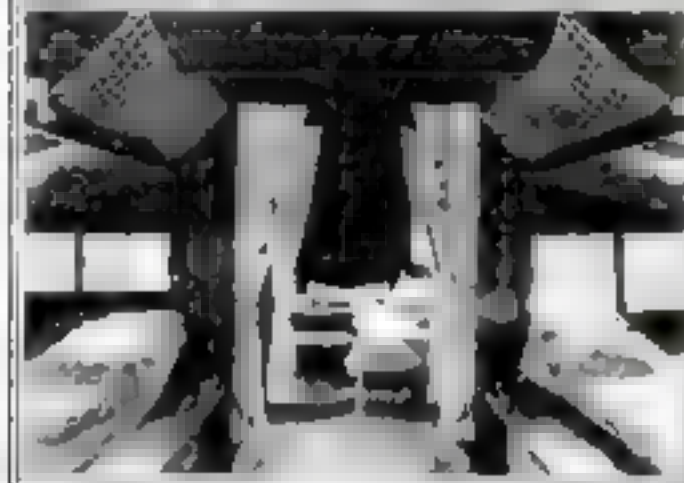


P. J. G. (Gen. Dr. J. H. M. M.) has invented a new type of tire which will increase the life of pneumatic tires fifty per cent. It locks the air in the tube for all time unless a blowout or puncture releases it. No more leaky tire valves or flat tires if this device is attached to your tires. It will reduce pneumatic worries to a minimum

in Accessories for the Automobilit



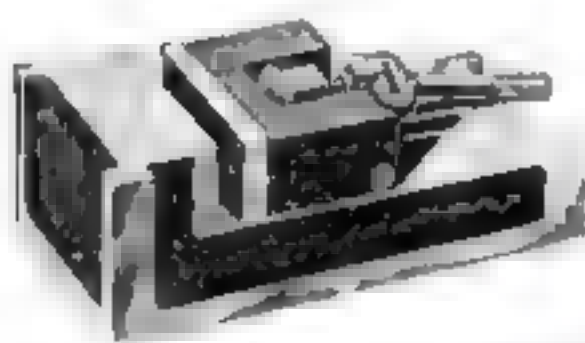
The motor bungalow is a compact vehicle with kitchen, pantry, toilet facilities, ice box, clothes and bedding lockers, electric lights, a running water system, a table, and a tent cot for the chauffeur. Why stop at a hotel when you can carry one along?



New inside flanges and three collar stud bolts change the ordinary Ford wheel into one that can be put on or removed in a few seconds.



A leather pad fastened to your automobile door in the manner here shown protects the door top from being marred or scratched.



The feature of this new shop vise is quick jaw action, secured by the screw adjustment and the universally pivoted handle.



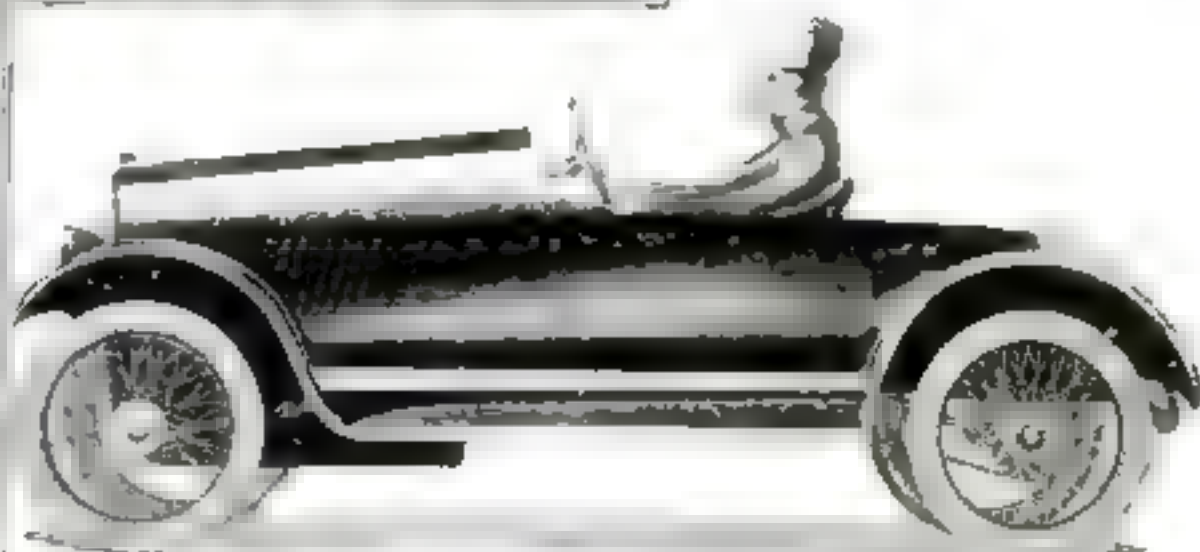
A new spark-plug tester tests the plug inside its chamber. A heavy glass lens at the end opposite the cap permits a view of electrical leaks in the plug.



This carburetor has but a single adjustment, which is set for all points between high and low speed. Its makers claim a ten-cent-a-gallon saving of gasoline.



This spark plug is constructed with a static condenser that fires in a vacuum in the plug. The flame fires through oil.



At last—a car for everybody at a price that everybody can pay. True, it accommodates only one passenger and has two cylinders; but then, its maker states that it runs fifty miles to the gallon of gasoline.

Electric Wrench for Automobiles



Why be bothered with removing bolts by hand when an electric wrench will do it quickly?

THE electric wrench is a new power-driven combination tool by which nuts or bolts may be readily screwed into position or removed without danger of breaking the bolts. It is useful also as a screwdriver or as a portable drill. It has a specially constructed clutch with an adjustable pressure of from ten to sixty pounds. When a nut or bolt reaches its desired position the power is automatically shut off.

Among the many uses of the electric wrench are those of power buffer or grinder. It is especially valuable for grinding out auto-

mobile cylinders and valves. There are special folding or locking handles, so it can be used by hand for starting or loosening nuts or bolts that have become rusty. The motor will operate in either direction, with three speeds forward and the same number when reversed.

This new tool embodies certain mechanical principles that have never been combined in this way before. It makes possible the use of a rapidly revolving tool propelled by greater power without danger or fear of damage.

The cost of operation is said to be from two to five cents an hour.

A Combination Measure and Funnel

If you have ever tried to pour lubricating oil into the breather-pipe of your automobile engine without the aid of a funnel, you know how much oil is wasted that way. Of course, no motorist wants to waste expensive lubricating oil, but many times the funnel is mislaid or lost.

With the combination measure and funnel shown in the accompanying

illustration, this would be impossible, for the funnel is an integral part of the measure. The funnel is in the form of a flexible metal pipe which can easily be bent so as to reach inaccessible oil-filling plugs such as the one shown in the picture.

This measure comes in three sizes, to hold one quart, two quarts, or one gallon.



Many and varied are the ways for carrying automobile bodies. Our manufacturer carries twenty-one bodies on a truck and trailer.

Shipping Automobile Bodies by Truck

BECAUSE automobile production is far behind the demand, many passenger-car makers have had to resort to new means of getting materials shipped from other factories. Among other things which it is necessary to have in order to sell cars, is the body. These are not generally made in the same plant where the machine-work on the metal parts of the car is carried on.

This was the case of an Ohio car-maker whose body plant was one hundred miles away. The usual shipping time by railroad between the two points is one week. Recently a whole new series of cars was held up because the bodies had not arrived.

Because of the run-down condition of the railways, delays became more and more numerous. As a result, the passenger-car maker had to call in

his younger brother, the motor-truck maker, to help him out.

Exactly how this was done is shown in the accompanying illustration. This motor-truck and trailer can carry twenty-one car bodies, the same number that can be loaded into a forty-foot railroad car. It makes the round-trip distance between the body plant and the car factory by road in twenty hours, including the time of loading and unloading. This means an average road speed of fifteen miles an hour.

While it costs more to ship car bodies in this way, it is worth while because of the certainty of the delivery. Special racks are used on the truck and the trailer, and provision is made for bolting the bodies down to prevent damage.



A combination measure and funnel.

Carrying Eggs Without Breaking Them

SEVERAL United States mail motor-trucks operating on the rural truck routes out of Washington, D. C., make use of an ordinary canvas-covered mattress to protect the cases of eggs in transit.

The post-office rural delivery trucks must maintain their schedules irrespective of road conditions, and when any speed is attempted over poor roads the entire load is sometimes thrown an inch or two off the floor. Without the mattress to cushion the cases when they come down, many eggs are broken, with resultant loss either to the farmer or the government.



The mattress in the bottom of the truck saves the eggs from breaking.

Very Latest Fashions in Automobile Bodies

Stop and admire the luxurious smartness of these automobile bodies: wouldn't you be proud to own one?



A coupé for four has a decidedly low hung appearance, due to a new method of body-mounting in combination with a long wheel-base. The body sides are very deep and the interior well arranged.

Riding at high speed over shell-holes and rough roads demanded a substantially built car. General Pershing chose the very best for this work, and it stood up under the strain.



Clara Kimball Young likes to pose in her own specially built car. It is credited with ninety horsepower and carries the disk wheel clear of the fender.



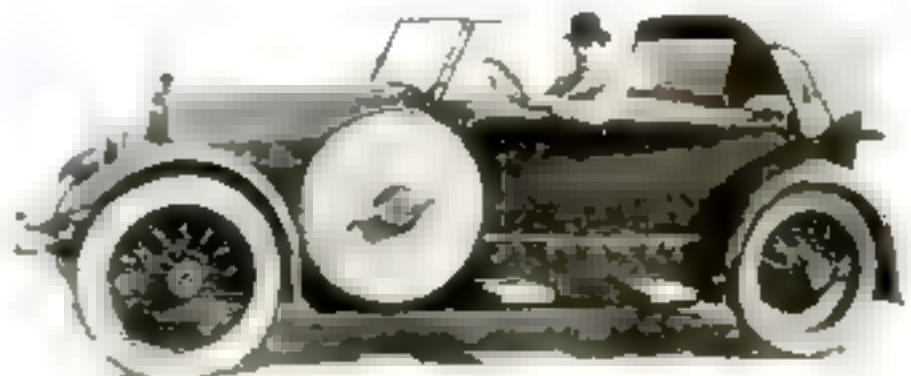
Even roadsters have enclosed bodies these modern days. Here is one in which are incorporated many interesting refinements.



This new sedan has a spring suspension which is unique in that the springs are at an angle to the car's axle. Its price is moderate.



While in sedan dress, the fact is noted that there are only two doors. Its engine has several unusual features, and increased power is claimed over previous models of its make.



One moving picture actor decided that standard bodies were not individual enough for him, and he designed this special body, which reflects his excellent construction ideas.

Exposing the Double Exposure in Moving Pictures

Strange feats made possible by the tricks of the camera

By Dorothea B. Herzog

HAVE you ever wondered how a "movie" star could shake hands with herself? In the first picture Genevieve Fluff, famous for her work in the five-reel thriller "Double Exposure," is doing this. According to Arthur Mider, the camera-man, this is how it is done.

Double exposure means two pictures on the same film footage. First, one half of the film is masked off by shoving half in front of the camera's lens a mat—a thin piece of black cardboard. The same method is used in taking the second half.

The action of the star is regulated by counts. The camera-man counts—say, up to ten; the director instructs the star what to do during these counts; and the star plays the skilled marionette. But to shake hands with oneself is a difficult feat. Perfect cooperation of the principals and exquisite finesse in the art of double exposure are required. Among the many mishaps that beset double exposures, four loom up prodigiously.

1. The mat that "splits" the film in half may slip, or the camera-man may accidentally move it a fraction of an inch. The line of demarcation being thus shifted, the exposure would be ruined.

2. Lack of synchronism by the three principals; in moving-picture parlance such an error is termed "disjointed action."

3. The carbon lights illuminating either scene may flicker—as a lamp often does.

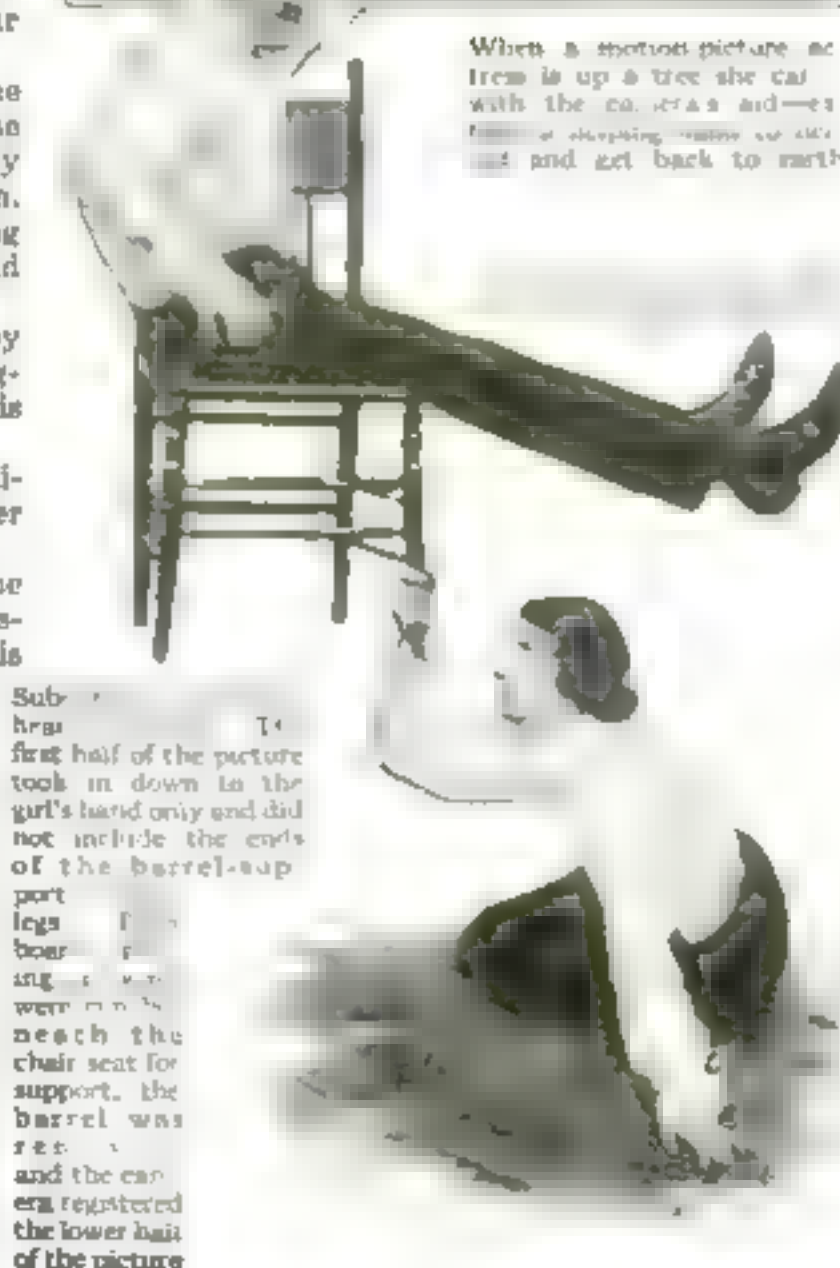
4. If the first half of the double exposure is taken satisfactorily, but the second half is not, it must be retaken.

Philip Hatkin, another expert double-exposure "shooter," recalls an instance when it took seven hours for a man to shake hands with himself. Why? By explaining how the picture above was taken, you will understand.

Genevieve Fluff is going to shake hands with herself. The camera-man prepares his camera. The director turns to Genevieve. "Did you put the cardboard inside the sleeve that is to rest against the tree?" Genevieve



When a motion picture scene is up a tree she can with the camera and—
of sleeping, resting her side
and get back to earth



Sub-
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14
first half of the picture
took in down in the
girl's hand only and did
not include the ends
of the barrel-sap
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support, the
barrel was
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and the cam-
era registered
the lower half
of the picture

noda. The camera-man comes forward. "Listen," he explains, sketching the action of the first double-exposure scene. "While I count up to five, you walk over to the tree. When I say 6, 7, 8, you extend your arms upwards." The scene is rehearsed, Genevieve's actions in accord with instructions.

Notices that all of Genevieve is taken except her hand. Why isn't the hand taken? Because at the count of 8 it extends beyond that part of the film exposed to the light, and is therefore cut off by the mat that splits the film in two.

Before Genevieve moves her position, her sleeve is nailed to the tree's trunk. Here is where the cardboard, holding the sleeve in position, proves its worth. As Genevieve wiggles out, another girl, whose hand resembles Genevieve's, wiggles in.

Genevieve hurriedly slips into a shirt-waist, a replica of the other. The camera-man prepares his camera. Holding the mat that masks off the blank half of the film, he shoves in a similar mat from the other side, being sure they fit snugly. He now counts and reverses the crank of his camera. At 9 the film is where it formerly was. The mat covering the blank side is cautiously withdrawn, the completed half of the film remaining masked off.

Genevieve now returns. She climbs into the tree. The "extra" in Genevieve's pose on the ground is ready to extend her hand. But only her hand and a bit of the shirt-waist sleeve crosses the line dividing the film in half at the count of 8. If all goes well, the hand and sleeve will neatly fit Genevieve's arm on the first side of the exposure. Genevieve will shake hands with herself!

"While we count up to 5," rehearses the director to Genevieve, "you say, 'Oh, I don't want to jump down; I'm afraid.' At 6, 7, slowly extend your hand; at 8 grasp the girl's hand as it comes forward." The result on the screen will be Genevieve's arm on one side, and a hand clasping Genevieve's hand on the other.

Camera-men speak of a seven-hour double-exposure as a mere trifle.



Q U A L I T Y

THE QUALITY OF B·V·D·
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TRADITION WITH ITS
MAKERS AND A PROVERB
WITH ITS WEARERS

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WITHOUT THE ABOVE
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THE B·V·D·COMPANY
NEW YORK

How to Make a Split-Bamboo Fishing-Rod

Making your own apparatus adds much to the pleasure of fishing

By Stillman Taylor



ANYONE who can handle a plane well enough to smooth a strip of wood sufficiently to make a good glued joint will find no great difficulty in making his own split-bamboo fishing rod. I speak from experience because I am merely an amateur with tools and have made over a dozen split-bamboo rods that compare very favorably with those costing three times as much as mine.

The simple outfit that I have found most convenient consists of a 6- or 8-in. smoothing or block plane, a 6- or 8-in. bastard cut flat mill file, a steel cabinet scraper, a center gage, a few sheets of No. 1, 0, and 00 sandpaper, and a can of good glue.

The exact dimensions for two useful rods are shown in Fig. 1, but any rod may be copied by finding the true taper and measuring the diameter with a caliper at 6-in. intervals from the butt to the tip. The dimensions given cover the specifications for a two-piece one-joint bait-casting rod and a three-piece two-joint fly rod. I have made several rods to these measurements and they have proved of good action, not too heavy, and with sufficient backbone to stand a great deal of hard use.

Making a rod of split bamboo is necessarily more complicated than planing a single piece of wood to form a solid wood rod, but if each step of the work is carefully done the amateur will succeed in turning out a good rod.

As the strips of bamboo are split from the whole pole, they must be planed to a triangular shape and glued together as shown in Fig. 2. Some kind of a block to hold the flexible strips securely is necessary. I use two planing blocks, made by planing off the corners of a block of hard maple or birch, each block being 3 ft. long, 1½ in. wide, and 1½ in. thick.

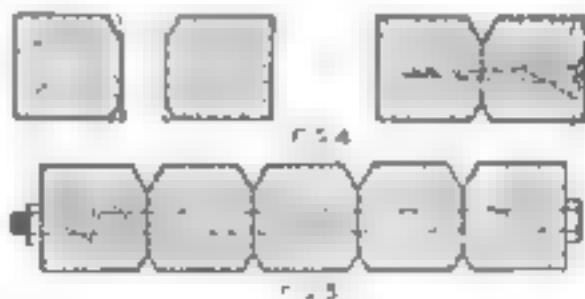
The angle for planing off the corners so that the two blocks may be joined

to form a 60-degree V-shaped groove is found by the 60-degree notches on the steel center gage shown in Fig. 3. These can be purchased at all tool stores and cost about twenty-five cents. As this is made of hardened steel it may be used to true up the

grooves, and a common three-cornered file may also be used for the same purpose, as it has angles of 60 degrees. The depth of this groove is not important, but merely the shape, and it must have true angles of 60 degrees, otherwise the strips cannot be planed to exact angles. The block shown in Fig. 4 is used for the first rough planing, and the larger block, shown in Fig. 5, for the final planing. Screws will fasten the two blocks together, while a common carriage bolt will clamp the other ones firmly together. The larger grooves are used for holding the larger sized strips of bamboo used in forming the butt and middle joint of the rod, while the smaller grooves on the other side of the block are used for holding the small strips used in making the second joint and the tips.

How to Split the Cane

There are two kinds of whole bamboo poles—one known as Calcutta and the other as Tonkin cane. They are equally good for rod-making. Select sound and thick-walled canes and only those of a good yellow color, as canes of greenish color indicate only partly



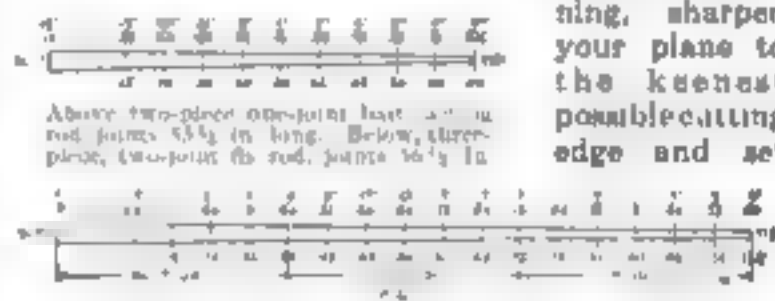
The block in Fig. 4 is used for the first planing, and the larger block (Fig. 5) for the final planing. Screws will fasten the two together.

seasoned wood. No canes less than 1½ in. in diameter at the butt end are worth using.

The strips are made by splitting the whole cane in halves and then quartering these sections. Split through the eyes, which are the cup-like hollows where the leaves grow. After splitting, select only the most perfect strips for making your rod. A sharp knife is a handicap in splitting the bamboo, so

use a common case or table knife. Place all the selected strips side by side on the bench and match them up so that the knots are as far apart as possible. Then saw off all the ends, evenly, about 2 in. longer than the finished joint of your rod is to be, and then mark all the strips at one end, that they may not be reversed.

Before beginning, sharpen your plane to the keenest possible cutting edge and set



The exact dimensions of two useful rods. Any rod may be copied by finding its true taper and measuring its diameter with a caliper.

the plane-iron fairly fine for the first final beveling. The tough bamboo quickly dulls the edge, and therefore it must be now and then resharpened, for it is impossible to make a good planed joint without the keenest edge on the iron.

Each strip is planed to a triangular section (Fig. 2) with each side of the strip to a perfect right angle of 60 degrees. This is done by laying a strip in the groove in the block, enamel side out, as shown at A in Fig. 6, and planing off flush with the top of block. This done, shift the strip to the position shown at B in Fig. 6, with enamel side down, and plane off flush to the block. Now select two perfect strips that match well and place together in the groove, enamel side down, as shown at C in Fig. 6, and plane both off flush with top of block. Proceed in the same manner in getting out the six strips which make each joint of the rod.

All planing is done on the soft part or inside of the cane, for the enamel must not be pared away at all to make a good rod. When using your plane, put an old glove on the left hand, which holds the strip, and when planing through knots hold the plane at a slight angle to the strip to shear off the knots cleanly and not break the fibers of the wood.

My experience suggests that the beginner will find it easiest to finish one step of the work at a time and to finish planing all the strips which are to form the larger pieces of the butt joint of the rod and then glue them up before attempting the smaller sections. The butt joint first, then the middle joint and lastly the finer tips is the logical order of procedure in rod-making.

A good glued joint can only be made



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when the strips are first placed as smooth as possible with a keen-edged plane-iron that is set fine to take off a smooth shaving without nicking the surface in the least. As a split-bamboo rod is made of six pieces, it is absolutely necessary that each face of the triangular strip be made smooth and with a velvet finish to afford a good "tooth" for the glue. In using the flat mill file in this way the strip is placed in a groove in the block and the file placed at right angles to the strip and the filing is done not cross-wise of the grain but with it, which is just the reverse of the usual manner of using a file. By referring to Fig. 7 you will have a clear idea how the strip should be finished with the file preparatory to gluing all together to form the six-piece rod.

The work should be checked up frequently with a center gage to be sure that each face of the triangular strip is a perfect 60-degree angle with clean and sharp edges. This is very important, for slightly rounding the edges will make it difficult to form a strong glued joint.

Gluing the Six Strips Together

The best grades of cabinet glue may be used, but I have obtained uniformly good results by using some good ready prepared glue.

In using the glue it is important to have it hot and thin. The liquid glue will prove satisfactory only if it is used in this way, and after once heating it should not be warmed up again. For this reason I pour only a

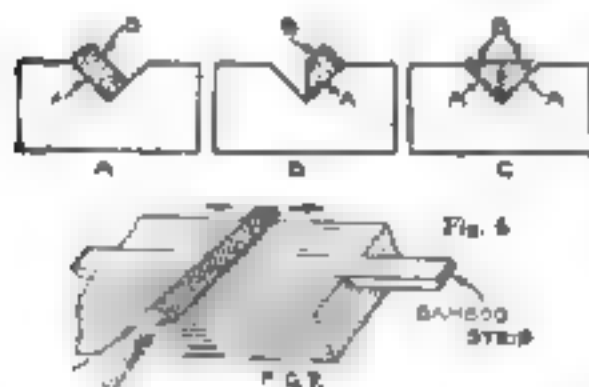
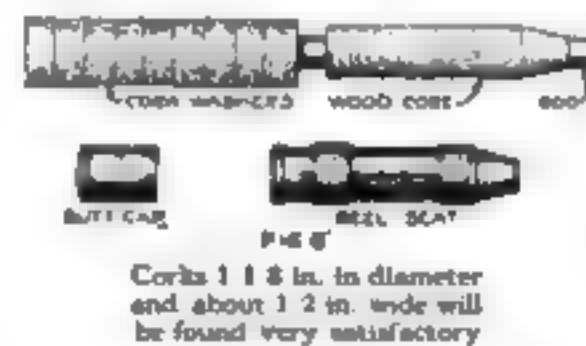


Fig. 6 shows how the strips are laid in the groove of the blocks with the enamel side out. Fig. 7 shows how the strip should be finished

very little glue from the can or bottle, place it in a separate can, and keep it in a pot of boiling water until through using it. I then throw away what is left and use fresh glue the next time.

The six strips which form each section or joint of the rod are glued together at the same time. It cannot be properly done separately. Before gluing fit the strips together and see that the beveled sides of the strips fit snugly together. If filing has been well and carefully done all the strips will lie perfectly even together. But if this is not the case, and one strip should sink below the level of the others, it is better to work up a new and more perfect strip rather than to patch it up by gluing in a strip of paper to fill up.

The six strips are fitted together and wrapped with common linen thread wound spirally around them. The strips may now be glued up. To do this in the easiest way, unwrap the thread from the large end to the center, spring open the strips, and insert a pencil between them to keep them apart. Now brush on the thin hot glue with a small flat brush, and be careful to touch all the surface of the strips. Next squeeze the strips together and rewind with the thread to force the strips together and make a firm and compact waterproof joint. Unwind the other half of the section and glue in the same manner and re-



wind with thread. The glued section of the rod should be placed in a warm dry room to dry and should not be mounted for four weeks, by which time the glue has thoroughly hardened and the wood shrunk as much as it is likely to.

As the strength and flexibility of a rod depends upon preserving all of the hard, glass-like enamel intact, this must on no account be pared away. When removing the wrappings from the joint, No. 00 sandpaper may be very lightly used to smooth up the surface.

The Cork Hand Grasp

A hand grasp or butt is best made from cork washers glued to the rod. In making this form of grasp, which is the choice of practically all expert anglers, the corks may be bought ready punched when the fittings are bought of a tackle dealer, or you may punch them yourself, using a regular punch of suitable diameter; or sharpen an ordinary piece of tubing of an old rod ferrule of the required size and make the hole in the center of the corks by means of a rotary motion. Do not try to drive the cutter through the cork, for this will only leave a ragged hole. Corks 1 1/8 in. in diam-

eter and about 1/4 in. wide are satisfactory. Details of the cork grip are shown in Fig. 8.

After punching enough corks to make the hand grasp of the required length—about 9 in. for a bait-casting rod and 12 in. for a fly rod—push on the first cork flush with the butt end of the rod, coat the top of this cork with thin hot glue, and push down the second cork in contact. Proceed in this manner to build up the grip.

To make the metal reel-seat a good fit, a wooden core or sleeve of soft wood is first shaped to slip snugly over the rod and the outside shaped to make a snug fit when the reel-seat is placed over it. This detail is shown in Fig. 8. After the corks are all in position, the core is slipped down to butt against the topmost cork and glued to the rod. The reel-seat is now slipped over the wood core and in turn glued to it, which makes a tight and waterproof joint that will never work loose.

The hand grasp may now be worked down to the desired oval shape, using No. 1 sandpaper, or the rough paring down may be done with a very sharp knife, finishing with fine sandpaper to make the smooth finish. The butt cap is now glued on.

The hand grasp for the fly rod is made in the same way as the one described for making the bait-casting rod, only the reel-seat is placed below the cork grasp instead of above it, and the same wooden core is used to make a snug fit.

Putting on the Ferrules

Shouldered ferrules are the best and the female ferrule or ferrule center is snugly put on by making a shoulder on the rod as shown in Fig. 9. This is best done by filing the wood down until it is a snug fit in the ferrule. Cement the ferrules on with the special ferrule cement sold for this purpose. Melt the cement and smear a little on the wood and a little inside the tube, and shove down into position close against the shoulder of the rod. Tips are cemented on in the same way as the ferrules. The whole rod should now be given a thin coat of light coach varnish.

The guides are attached by means of the invisible knot shown in Fig. 10,



Showing how the guides are whipped on and how the bands of six are wound



Copyright © 1919 by The Goodyear Tire & Rubber Co.

20% More Production—and the G. T. M.

A quarter turn on short centers, a heavy crown pulley, and the presence of considerable moisture where the belt had to work, kept the Iroquois Pulp & Paper Company, of McKeever, New York, buying a new belt every 30 days for their rotary screen drive. That was before the G. T. M.—Goodyear Technical Man—analyzed the drive to determine what belt would do the best work and last the longest time on it.

The G. T. M. based his recommendations not on the fact that he was a Goodyear man and had belts to sell, but on his practical knowledge of belting plus a careful study of every feature of each drive. He figured in all the factors that affected belt performance and life—30 horsepower to be transmitted, a drive from a 24-inch pulley on a line shaft to a 23 $\frac{1}{2}$ -inch pulley on the rotary screen, a quarter turn on short centers—only 8 feet—a speed of 2,780 feet per minute, and a heavy damp prevailing all the time.

An 8-inch, 8-ply Goodyear Blue Streak met the requirements. Its friction surface held the pulleys in a firm grip that prevented slippage and transmitted full power. Subjected to the heavy moisture, it did not stretch. To the severe strain imposed by the duty on the quarter turn it responded with inbuilt strength and flexibility.

Four Months of Goodyear Blue Streak service—you will recall that previous belts wore out at the rate of one a month—not only cut belting cost by 50% but also established an operating record of 20% increase in production. The men and machines were going on with their work instead of waiting while the rotary screen had its belt taken up again.

A plant analysis which included a detailed study of every drive in the Iroquois plant was made at Supt. Archie Brown's suggestion when the G. T. M. dropped in to see how the Goodyear Blue Streak was working. In line with the same scientific method of conserving and utilizing the full energy of the plant, the Company has installed Goodyear Hose and Goodyear Packing, confident of the same economical, long-lived service from them as from their Goodyear belt.

If you have a belt problem, involving either a single drive or an entire plant, there is something of value for you in the Goodyear analysis idea. The G. T. M.'s time and experience are at your command without charge. If he specifies a Goodyear product, you may rely on its ability to do more and better work, over a longer period of time, at lowest final cost.

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Use "X" Liquid instead of soldering your radiator

ONCE a man understands the construction of a radiator he never solders leaks.

A radiator is a delicate piece of mechanism. The walls are as thin as a sheet of paper and perhaps 1-16th of an inch apart. The 3000 or more cells in the average honeycomb radiator have about 16,000 square inches of cooling surface—with more than 24,000 corners that may leak.

Imagine hunting for a leak with a white-hot soldering torch and trying to do the exacting work of welding the break! Solder is hit-or-miss guess-work. The tremendous heat of the soldering iron expands the thin tubes and weakens the radiator. This causes more leaks and additional expense.

• • •

WITH "X" Liquid any leak can be repaired in ten minutes. You can do a safe, certain job—at a small part of the cost of soldering.

"X" is simply poured into the radiator. Not only does it find every leak or break in the radiator, but also leaks in the pump, connections, water-jacket or elsewhere, and it makes a repair that stands 2000 pounds pressure!

Thousands of car owners keep "X" Liquid always in the water to prevent future leaks.



Eliminates Rust and Scale

In every water-cooled car, Rust is constantly destroying cooling system walls and thick layers of Scale bottle up the heat and cause overheating, breakdown of the lubricating film and much engine trouble.

The chemical composition of "X" is such that it *lessens* all Rust and Scale now present. It absorbs the free oxygen in the water. This prevents new Rust from forming. And "X" does not allow the lime and magnesia in the water to deposit new Scale.

In this way the narrow water passages are kept free from RUST and SCALE. Cooling is greatly improved. Oil is saved. And the motor performs better.

Not a Radiator Cement

Radiator Cements, flaxseed meals, etc., either in powder or liquid form, which float in the water, will clog the water passages and cause trouble. "X" Liquid is not a radiator cement, flaxseed meal, glue or "dope." It is a combination of chemicals that works *chemically*. Be safe. Ask for the original "X" Liquid.

It is used by the United States Government, Standard Oil Co., and others whose standards are equally as high.

Large Size \$1.50
Will do \$25.00 in repair work

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mailed direct on
receipt of
price

Write for proof
of how we can
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\$150.00 welding job



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makes all water cooling systems
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and the bands of silk wound on in $\frac{1}{8}$ -in. wide bands, 4 or 6 in. apart from the butt to the tip of the rod, are put on in the same manner. Apple green and scarlet are the most attractive and durable colors. Regular sewing silk in size A is satisfactory. If a finer silk is wanted for finishing the slender tips, simply untwist the A thread and use one or two strands as preferred. After putting on all the guides and windings, coat the bands of silk with white shellac varnish, to prevent the color turning when the rod is varnished. Do not allow any shellac to touch the wood, however.

Aside from four or five natural canes or bamboo poles, which furnish the material, the list of fittings include the following:

For Single-Tip Ball-Casting Rod

- 1 German silver Reel-seat, with straight hood, $\frac{3}{8}$ in. diameter
- 1 German silver Taper, small end about 15-32 in.
- 1 German silver Butt Cap, $\frac{1}{8}$ in.
- 2 Agate Casting Guides, $\frac{1}{8}$ in.
- 1 Agate Offset Casting Top

For Two-Piece Ball-Casting Rod

Same fittings as given for single-tip casting rods, with the addition of one German silver shouldered and welded ferrule, 17-64 in. in diameter with two closed end centers.

For Three-Piece Fly Rod

- 1 German silver Fly-rod Reel-seat with attached butt cap, $\frac{3}{8}$ in.
- 1 German silver Taper, small end 33-64 in.
- 1 German silver shouldered and welded Ferrule, 9-32 in.
- 1 German silver shouldered and welded Ferrule, 11-64 in. with two closed end centers, one for each tip.
- 1 No. 4 German silver Snake Guide for butt joint.
- 4 No. 3 German silver Snake Guides for middle joint.
- 3 No. 2 German silver Snake Guides for tip joint.
- 2 No. 7 Agate Fly Tops, split pattern to wind on with silk. Two spools of sewing silk in contrasting colors for each rod.

A Useful Threading Tool for a Lathe

AN easily made internal threading tool can be made from a tool-steel rod. The V-edged disk has a segment cut out, leaving a radial cutting edge.



This useful little tool for turning internal threads can be made from a piece of tool-steel rod

The reduced diameter shank may be held in a small V-block in the tool-post. The cutting point is sharpened in the same manner as a circular forming tool, by grinding the cutting edge on a radial line with the center.

Saving the Money That Goes Out of the Exhaust

AUTOMOBILE engines are built to consume gas. But the fuel of today is not readily converted into gas. It is too heavy—too much like kerosene. It does not vaporize. Some of it is fed to the engine in the form of raw drops. And these raw drops are wasted. Besides they give rise to carbon and to most of the troubles that mean heavy repair bills.

When the gasoline situation became critical, the Chalmers engineers decided that engines must burn the fuel of today instead of wasting it. They devised the Hot Spot engine with the Ram's-horn intake manifold.

What is the Hot Spot? What is the Ram's-horn?

In the Chalmers engine the gasoline, wholly or partially vaporized, strikes a Hot Spot before it enters a cylinder. Instantly the drops are

changed into "gas." Not raw fuel, but "gas" is fed to the engine—something which will burn.

The Ram's-horn intake manifold makes it easy for this pre-heated, completely vaporized fuel to enter the cylinders. It is shaped like a ram's horn in order to get rid of sharp corners. Every gas is composed of billions of particles. Those in vaporized gasoline rush into the engine at the speed of 100 miles an hour. They must not be stopped suddenly by a corner. The Ram's-horn makes it easy for them to enter the cylinders.

The Hot Spot and Ram's-horn do this: 1. They make it easy to start. 2. They give you more miles per gallon of gasoline. 3. They reduce carbon deposits in the cylinder. 4. They make it impossible for raw, unburnt fuel to drop down into the crank case and "cut" the lubricating oil.

CHALMERS MOTOR CAR COMPANY, DETROIT, MICHIGAN

CHALMERS MOTOR CO. OF CANADA, LTD., WINDSOR, ONTARIO
MAXWELL MOTOR SALES CORP., EXPORT DIVISION, 1508 B'WAY, NEW YORK



An Airplane Kite for a Man to Fly

By C. P. Bradley

GOOD kite-sticks can be made from white pine lath by sawing each lath into three parts. Smooth the sticks with a plane if you have one, because you are liable to split or cut them too thin if you whittle the sticks.

If you do not wish to make a kite as large as this you can reduce the dimensions proportionately.

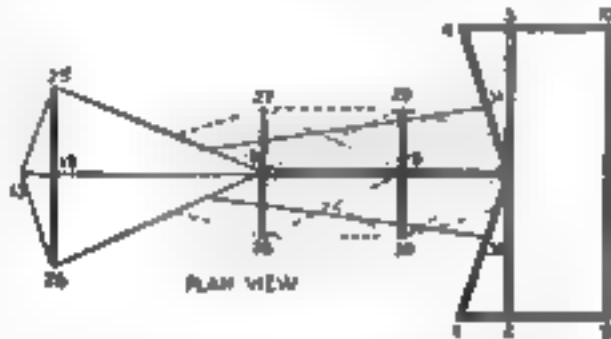
Make the plane section first, using sticks of the dimensions given in Fig. 1.

1. Nail 9-10, 10-12, and 12-9 together to form a triangle, then nail in 12-7. Nail 1-9, 2-3, and 4-10 together, and attach to the triangle at 9 and 10. Nail 11-12 at 12, and nail 5-11 to this at 11. Then nail 5-11 at 5, and put in the brace 6-8. Attach 1-11 and 4-11 at 1, 11, and 4, and you have the framework of the planes.

Now go over each joint and tie every one with string. Make it impossible to pull them apart. In places such as 7 and 12 run the string all the way from one to the other several times, because you will have to depend on that to hold the sticks together. A $\frac{3}{4}$ -in. No. 18 wire nail is as large as you should use, and it only serves to hold the sticks in place. Now brace the whole plane section with string. Run string from 1 to 12, 12 to 4, 10 to 11, 11 to 9,

9 to 3, 10 to 2, 6 to 12, and 8 to 11 (as represented by the dotted lines). Draw the strings as tightly as you can, because the whole thing must be so well braced that it can be picked up anywhere without losing its shape.

Lay this aside and start the tail section by making the two long sticks required by Fig. 2. More strength is required by these sticks than any others in the whole kite, and, while quarter-inch sticks are



Draw the strings as tightly as you can; the whole thing must be braced as tightly as possible.

large enough at all other places, it would be well to use half-inch for these. If you cannot get an 8-ft. piece, use the method shown in Fig. 3, and join what you have. Bevel the ends, a piece of the same size, and wrap string around the whole thing. Where two sticks are to be nailed at about the same spot, stagger them a little, as in Fig. 4. This figure also shows that the end of every stick that does not attach to another should have a nail in the end to which the string may be fastened.

Nail 21-14 to 16-17. Nail 20-15 to 16-17 at 15. Nail in 22-20, and fit in the braces 18-24 and 19-23. Nail 13-14 at 14. Now tie all the joints together, and brace well, so that the sticks shown in Fig. 3 will keep their shape. To prevent any side motion it is necessary to brace this sideways.

To 20-15 attach the sticks 27-28 and 29-30 at 18 and 19 (Fig. 5). Nail 25-26 to 16-17 at 15. Now run all the strings shown by the dotted lines, excepting string 31-15 and 32-15, which will be attached later. Have them all tight, so that the sticks hold their position. Then run string from 25 to 16 to 26 to 17 to 25, and fasten well. See that the sticks 25-26 and 16-17 are held at an exact right angle. This completes the tail section.

To attach the two sections together, join them as in Fig. 6. The stick 5-11 of the plane is nailed to the stick 20-22 of the tail, and 11-12 of the plane to 22-21 of the tail. Wrap string around all of these and you are ready to cover it.

Paper such as butchers use, or any other kind of tough paper, may be

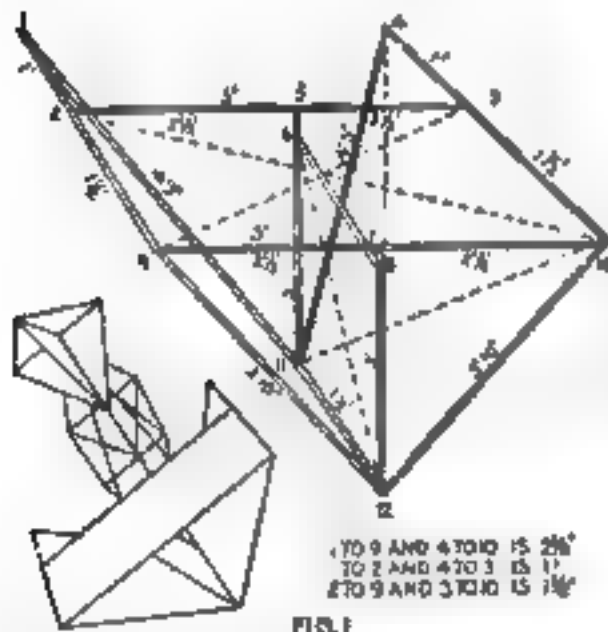


FIG. 1

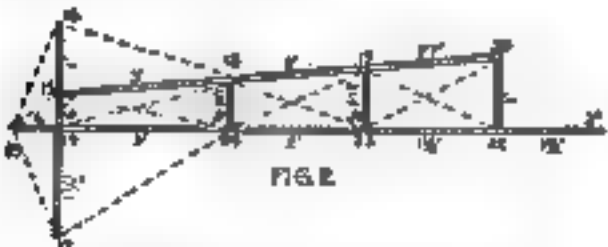


FIG. 2

Make the plane section first, using sticks of the dimensions given in Fig. 1. Start the tail section by making the two long sticks pictured in Fig. 2

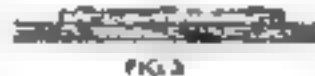


FIG. 3

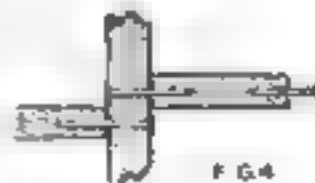


FIG. 4

If you cannot obtain an 8-ft. piece, join them as in Fig. 3. Where two sticks are to be nailed, stagger them a little (Fig. 4).



Here is the way it will appear when it is in the air. With a good breeze the kite will move a 100-pound wagon.

used. For paste, a thick mixture of flour and water will hold.

Lay plane side 1-9-12-11 flat on your paper, and cut all off but a 2-in. margin. Cover the sticks and the entire margin with paste, and rub down tightly. Do the same with the other plane. Now cover 2-9-10-3 with paper in the same way, making sure that the edges at 2-9 and 3-10 are fastened well. Paste 1-in. strips of paper over all strings that lie next to the paper to hold them to it.

Now run a string from 31 to 15 and from 15 to 32. Paste the edge of the paper to one string, draw around 21-14, and fold over the other string

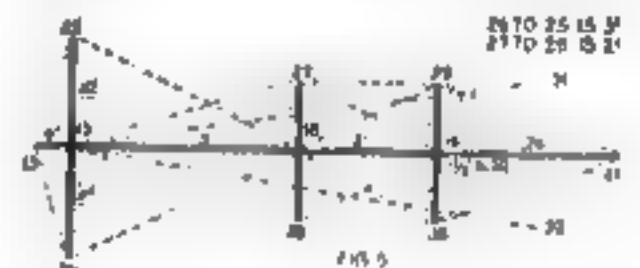


FIG. 5

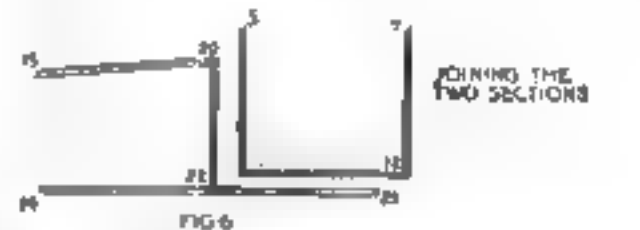


FIG. 6

The sticks are attached as shown in Fig. 5. When you have completed Fig. 6 the kite is ready for the string and paper covering.

to fit. Cut off all but the margin, and paste down. This gives you the hollow tapering section that forms the body. Fasten well at 31-20 and 20-32. Cover the section 13-16-18-15-14-24-17 with paper. Now run a string from 18 around 15 and back to 18. Also a short piece from 13 around 15 to 18. Paste paper over the sections 18-25-13-15-18 and over 18-26-13-15-18, and you have the kite complete.

The section 18-26-13-25 is the part that lifts the weight of the tail, and the section 13-25-26 that slopes down-

May, 1920

Contractors are quick to appreciate the value of improved equipment.

The greater resiliency of the Kelly-Springfield Caterpillar tire, its surefootedness under all conditions and its consistent mileage performances have made its economies so evident that leading contractors all over the country are adopting it, many using Caterpillars as exclusive equipment on their trucks.

Caterpillars save truck depreciation, decrease repair costs, cut down gasoline and oil consumption and give amazing traction.

They will both increase the efficiency of your trucks and enable them to operate more economically.

Kelly-Springfield Tire Co.
New York, N. Y.



KELLY SPRINGFIELD **TRUCK TIRES**

Insuring Comfort in Summer Footwear

Shoes for outing, tennis and everyday use

ALL over the country men are wearing Keds this season. You will find them in town or at the seashore—on the street or at the tennis court—wherever you go for work or play.

Keds are the ideal footwear for warm weather. Their elastic rubber soles put new life in your step. Their soft pliable fabric makes them always cool and comfortable.

Keds now include models made with regular welt soles and firmly boxed toes—just like leather shoes. This means a shoe of style and distinction—the very shoe you have needed to wear with your white flannels or Palm Beach suit.

With these additions, Keds are now a complete line of canvas summer shoes—ranging from the easy, less formal tennis shoe to the latest and most fashionable styles of footwear. Last year millions of pairs of Keds were worn by men, women and children.

Good dealers everywhere carry Keds. Ask to see the various models—notice how wonderfully light and comfortable they are. Look for the name Keds on the sole.

For men and women, \$1.50—\$6.00
For children . . . 2.15—4.50



The standard shoes for tennis, boxing and vacation wear. Made of the finest 10 high canvas in white or beige with black green or red rubber soles.

Keds



One of the smart special types for summer wear. Made of the finest white canvas 10 high or Oxford model, with welt sole construction which gives it all the style of leather shoes.



Sturdy shoes for sport and everyday wear for boys and girls. Made of heavy white or brown duck. Brown leather trimmings with white patch and rubber soles and toe cap.

United States Rubber Company

ward acts as a sort of brake to prevent the kite from sailing too near overhead. The vertical section of the tail acts as a rudder.

To find the place for the bridle, find the place along 21-24 where the kite could be suspended, keeping the stick in a horizontal position, then attach one string there. Take hold of 7-12 and find where you can suspend the kite, keeping 21-24 vertical. Attach the other string here. Now join both strings, and tie together at the point where 21-24 will hang at a 45-degree angle. Attach your flying-string to that.

By covering the paper and sticks with linseed-oil paint you will tighten the paper and strengthen the whole kite. Give the strings a coat of paraffin, because paint makes them too brittle.

Use a good grade of string or cord for your bridle and flying-string. With a favorable breeze, the kite will be able to move a weight of a hundred pounds on wheels—for instance, a small wagon.

If the kite should fly to one side or the other, run string from 4 to 25 and from 1 to 26. Tighten or loosen one or the other until you find the place where it flies steadily.

To Prevent Dry Grass from Sticking to a Rake

HOW many times have you raked up dried grass from your lawn with an ordinary wire rake and become disgusted with the way the grass stuck to the teeth? Many times, we know. A simple attachment, as illustrated, will eliminate this annoying trouble.

Three wooden blades hinged to the teeth of a wire lawn-rake will be found to more than double its efficiency. The blades clamp the material caught by the rake to the teeth. A quick push and shake cleans it.—EDWARD R. SMITH



Don't pull the grass from a rake with your hands. This device will do the trick easily.

Do You Economize on Your House Rugs?

IN an effort to economize, somebody recently discovered that the appearance of worn fiber rugs are greatly improved by an application of flat paint. That means a paint such as is generally used on interior walls, it has no gloss.

If desired the borders may be stenciled in a different color of the same product.

It is said that a rug thus treated will pass muster an additional season or two.



At our expense

Try this shaving soap
that multiplies itself
250 times

AFTER years of research and experiment, we have step by step, accomplished these things in Palmolive Shaving Cream.

We have made a soap which multiplies itself in lather 250-fold. One-half gram—a mere bit—suffices for a shave. A single tube supplies 152 shaves. That's a unique attainment. It means abundant lather from a touch of soap. Once men were quite content with soap hardly one-third so prolific.

Quick action

Every hair of the beard has an oil coat. This lather instantly emulsifies that oil. Then the beard—a horny substance—quickly absorbs water. It absorbs 15 per cent of water within one minute after lathering, as proved by laboratory tests. And that makes a wiry beard wax-like.

This achievement alone cost us 18 months of effort. And we tried out 130 formulas.

Lasting lather

This lather is creamy and tenacious. It maintains its foamy fullness for ten minutes on the face. Thus it doesn't need replacement. Such durability in lather used to be undreamed of. It means lasting lubrication for the shave.

This lather is also a lotion. It contains palm and olive oils. So the tenderest face requires no other application.

'Twill amaze you

Such statements, we know, sound like fiction to laymen.

But every fact here stated has been proved by scientific tests. Your own tests will confirm them. And they mean to you the same in luxurious shaving.

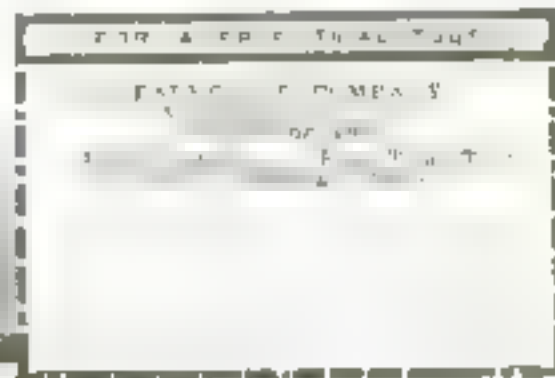
We are offering men a Free test tube of Palmolive Shaving Cream, to let them see its action and result.

Send us this coupon and we will mail you this Free Tube. Do this for your own sake. See what science has accomplished for you in this line.

Cut out the coupon now.



The Palmolive Company, Milwaukee, U. S. A.



United States

SAND PAPER

[illegible]

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[illegible]

Sand Paper is a Tool

Buy it as you would a tool—instead of just asking for "some sand paper". Buy the U. S. map brand that stays sharp—for every little particle of flint or garnet is a sharp-edged tool, glued everlastingly to strong cloth or tough-fibred paper especially made for the purpose.

United States Sand Paper is known everywhere by the map trademark. U.S. Flint and garnet (the semi-precious gem) are first choice in the wood working industry where it is used in sheets, endless belts, discs and wasteless rolls of convenient widths.

For finishing metal surfaces in foundries and machine shops, discs and belts of Herculundum and Carbalox from

the electric furnace, are time and labor savers—Herculundum for cast iron and similar materials; Carbalox for steel, brass, copper, aluminum, etc. We would welcome an opportunity to discuss this with you.

From the crushing of the materials to the last coat of glue, U. S. Sand Paper is surrounded with almost unbelievable precautions to insure uniformity of quality.

You cannot sharpen sand paper: therefore buy the best, the U. S. brand—because it stays with you until the job is done. If your dealer does not have U. S. Abrasives in stock, write direct to us. Our Service Department will recommend the one best grade for your particular work.

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**Hörsaal und Café der Studenten-
schaft**

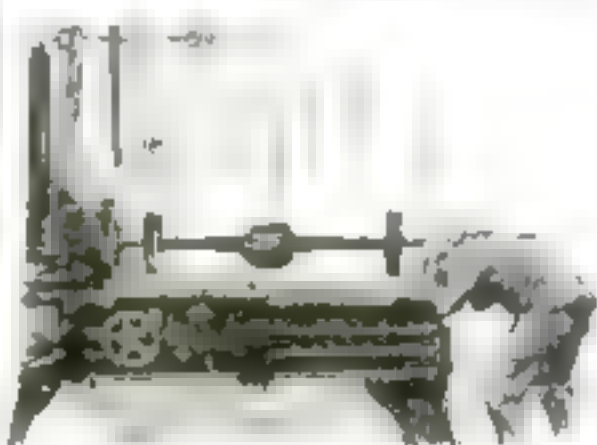


It's a good idea to get a lot of
 water and a lot of sand bags
 to use in a fire. We know how
 much water we need to make it.

To Straighten a Bent Rear Axle of an Automobile

ABENT rear axle-housing seemingly presents a difficult task to the mechanic, but it isn't as difficult as one would think.

The axle to be straightened is first placed in a heavy lathe. A fixture supports the axle on the face-plate at the right of the lathe. The bending pipe is slipped into the axle end, the shoulder of the mechanic at the



A machine lathe makes the straightening of an automobile axle an easy job.

extreme end of the pipe giving the necessary leverage. Obviously, when the axle has been properly trued it will rotate evenly on its axle.

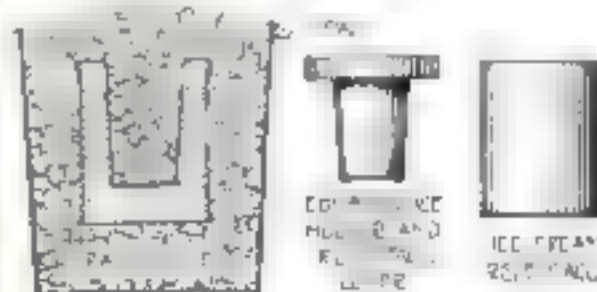
The fixture for this work is a heavy casting, which is bolted firmly to the face-plate and which holds the axle end snugly.

The different sized axles may be accommodated by using different sized bushings. — R. PRINGLE.

A Quick-Action Ice-Cream Freezer

THE exceedingly simple form of receiver for freezing ice cream shown in the accompanying illustration has proved by actual use to be a practical and quick means of producing a very fair quantity of ice cream. As may be seen, no crank-turning is necessary.

It comprises a cylindrical tin can in the cover of which a circular hole is



You can make an ice cream freezer that requires no cranking

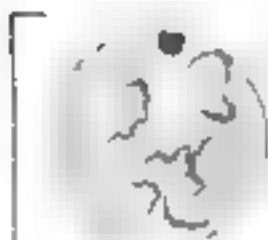
cut. To the cover a downwardly projecting tapered ice receptacle is soldered.

The freezing surface within and surrounding the receptacle is so great that a quick solidifying of the mixture is speedily assured.

The tapered form of the ice-container permits its free withdrawal from the receiver.



Man's Ancient Enemies, Invisible No More!



*Trypan-blue stain
on a drop of pus from
a patient with
the disease*

For countless years man lived in ignorance and fear of those dread scourges which devastated armies, made plague-spots of great cities, limited populations, and halted progress.

Then came the Microscope, the "Discoverer." And science detected virulent organisms, infinitely small, that attacked the human body. Invisi-

ble, they were also invincible—but once discovered and identified, science devised safeguards against infection, and commenced its patient cataloging of these, man's ancient enemies.

Epidemics still occur, but the task is not com-

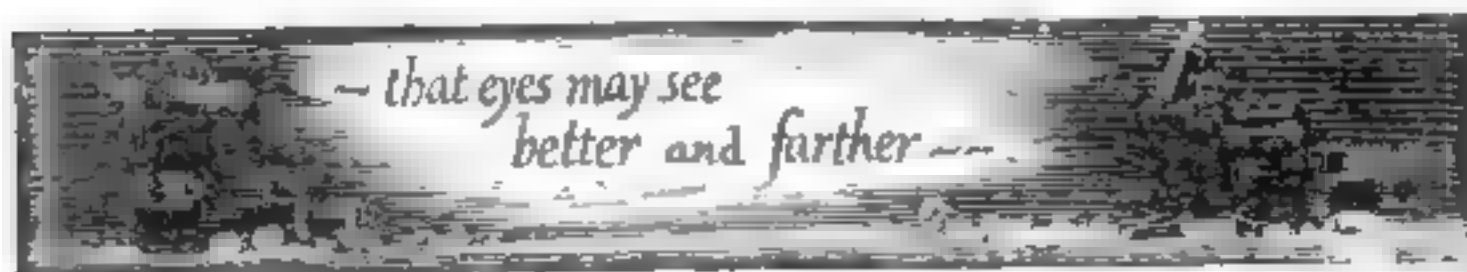
pleted. But the day will come when even the most secret of these tiny foes is identified—and mankind will owe that day to the microscope.

We made our first microscope nearly fifty years ago. It was an advance over earlier models—but it was crude indeed compared with our instruments of today, marvels of optical and mechanical precision, with perfectly-ground lenses no larger than pin-heads. In this field we have gone far. Perhaps in no other way have we served mankind better than by improving the microscope and aiding the crusade against disease.

Write for literature on any optical product in which you are interested

BAUSCH & LOMB OPTICAL COMPANY . . . ROCHESTER, N. Y.

*Makers of Eyeglasses and Spectacle Lenses, Photographic Lenses, Microscopes, Telescopes,
Binoculars, and Engineering and other Optical Instruments*



An Alarm to Announce the Charged Storage-Battery

TO avoid waste of current, a simple alarm was made in a battery-charging station to announce a charged battery. Completion of the recharging process is marked by the escape of gas from the cells.



Why wait around until a storage-battery is charged? Attach this alarm and you are warned when the charging is complete.

The device consists of a bent glass tube which is inserted in the opening of one of the battery cells, and, upon the formation of the gas a small amount of mercury in the tube is forced upward, making contact with two wires, which closes a dry-cell system with a

door-bell connected in.

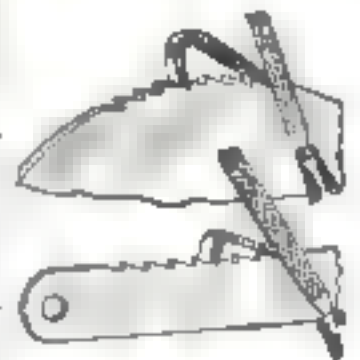
Take a length of glass tubing a foot long, and bend it as shown in the illustration. This should be of some small size, say a quarter inch inside measurement.

The lower end is inserted into a rubber cork of the proper size to fit the neck of one of the battery cells. The other end is filled with sealing-wax, after two bare copper wires are placed in it, far enough apart to prevent short-circuiting by contact. A small vent should be made in the sealing-wax with a pin before hardening, to allow the escape of air in the tube when the mercury rises.

The wires are then connected into the bell circuit.—DALE VAN HORN.

Filing Saw Teeth with a Spacing Gage

OFTENTIMES the mechanic finds it desirable to use a saw or a broach that is different in some respects from the standard tools of that nature, and to avoid the tedious job of setting up a milling-machine to cut the teeth on it he files them in by hand, gaging the pitch with his eye. Unless his eye is better than the average man's the result is bad.



A gage for spacing the filing on saw teeth can easily be made in the manner shown here.

To overcome this difficulty and get regularly spaced teeth, the gage shown in the illustration was invented. Any piece of cold-rolled steel will do if it is not too thin, and if the beveled edge is case-hardened it will last a long time.—FRANK HARRIS.

DURACORD

TRADE MARK

The portable electric cord that *wears*

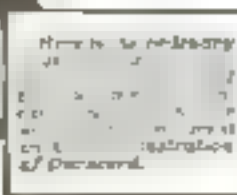
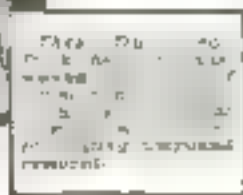
DURACORD is strong where other cords are weak—on the outside. It has a covering of thick, heavy, long fibre cotton woven like fire hose, not braided.

It is standard for portable electric tools and extension lamps in many of the largest plants in America. Before ordering Duracord, a number of these firms conducted exhaustive tests as to Duracord's ability to withstand the roughest kind of treatment. The results in every case proved that Duracord will outwear ordinary cords many times.

Duracord can be furnished in all sizes of portable electric cord and also in the larger sizes of single and duplex cable. Ask your electrical jobber about Duracord or let us send you samples of Duracord and ordinary cord for you to test and compare yourself.

TUBULAR WOVEN FABRIC CO.
Pawtucket, R. I.

Makers of Duracord
Flexible Non-Metallic Conduit
and tubular woven fabrics of all kinds





another
EVEREADY
contest!

\$10,000.00 In Cash Prizes

\$3000.00 First Prizes for a Thought

103 other prizes from \$1000.00 to \$10.00

ANOTHER Eveready contest! Another chance to win a big cash prize! Another incentive for active-minded men, women, boys and girls—for everybody with imagination!

On June 1, Daylo dealers throughout the United States and Canada will display in their windows the new Daylo Contest Picture. It has no title. The story it tells is a great big interesting, intensely human one. A thousand different people will see a thousand different stories in the picture. The story the picture tells you may be the most interesting—the prize winner—the story that may be worth \$3,000.00 to you.

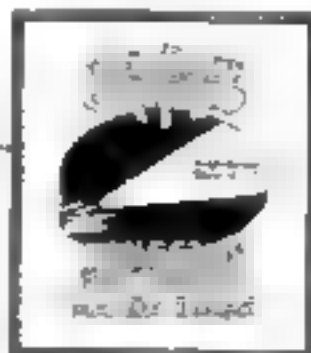
If your answer doesn't win first it may win the second prize \$1,000.00—or one of the 102 other prizes, none less than \$10.00.

Go to the store of a Daylo dealer. Study the picture in the window and write, on a contest blank which the dealer will give you, what you think the letter says. Use 12 words or less. For the best answer that conforms to the contest rules, the winner will receive \$3,000.00 in cash. Answers will be judged by the editors of **LIFE**. If two or more contestants submit the identical answer selected by the judges for any prize, the full amount of that prize will be paid to each.

Anyone may enter. There is no cost or obligation of any kind. Submit as many answers as you wish. But do not delay. Get an early look at the picture. Then send in your answers. Contest closes midnight, August 1st.

List of Prizes

1 First Prize \$3000.00	
1 Second Prize..... \$1000.00	
3 Prizes of \$500.00 each..... \$1500.00	
4 Prizes of \$250.00 each..... 1000.00	
5 Prizes of \$200.00 each..... 1000.00	
10 Prizes of \$100.00 each..... 1000.00	
10 Prizes of \$50.00 each..... 500.00	
20 Prizes of \$25.00 each..... 500.00	
50 Prizes of \$10.00 each..... 500.00	
104 Prizes.....	Total \$10,000.00



This Sign

on the window identifies Daylo dealers throughout the country who have contest blanks for you and the new Daylo Contest Picture on display. If you need new batteries for your flashlight, dealers displaying this sign can furnish you with the best—the long-lived Tungsten Battery.

Keep an Eye on Your Automobile

A frequent inspection is essential to motor upkeep

An automobile is a sensitive mechanical organism that requires considerate treatment. Drivers who are not mechanically inclined have neither the sympathy nor the respect for machinery that is necessary for its continued upkeep, and consequently it is something they should cultivate. Following are some suggestions that will give you an idea of how the expert works and just why his car is always ready in an emergency.

Most owners are neglectful of the body of the car, while paying strict attention to the engine, and thus cause themselves the inconvenience and embarrassment of hearing rattles. The body, while it must have a little attention, does not need much time, and if fenders, spokes, and windshields are watched noises can be avoided. Too little attention is given the spokes of the wheels. After some wear, due very often to friction and shrinkage of wood, the spokes become loose, not only causing unpleasant noises, but doing serious damage to the wheel and tire if not repaired immediately. Loose spokes throw the wheels out of true and the tires soon become ruined.

Are you a clutch rider? Does your foot continually rest on the pedal that controls this important part of your car? If so, you are unconsciously wasting power and are helping to put the clutch in a condition where it will slip permanently. Spend a few minutes studying your clutch—its makeup and the principles on which it works, learn how to keep it in condition; and likewise learn to keep your foot off the pedal when it is not necessary to keep it there.

Aside from a strainer in the tank, many cars have no provision for keeping out dirt from the carburetor. Owners of such cars will do well to fit a trap in the fuel line. All of the big carburetor makers offer these traps for sale, and they are placed in the fuel line near the carburetor or in the bottom of the tank. The trap catches all the dirt and water, and should be cleaned out regularly once a month.

It is very important that regular inspections should be made of the leather coverings or "boots" which protect the universals and other parts. Flying stones or sticks are apt partly to destroy these boots, permitting the lubricant to leak out and give an entrance to dust and dirt. Look them over once a month, anyway.

Undoubtedly the crudest part of the engine is the fan-belt, and yet it is a most important part. It certainly is a most frequent source of trouble, and by that token demands frequent and



Suddenly your engine develops a foreign noise above the steady purr of the exhaust. Don't wait until you get home to locate it. Do it now and avoid a breakdown.

careful attention by the car-owner. All fan-belts are provided with an adjustment, some easy, some less so, and these adjustments are necessary.

The wise motorist will not forget to give the fan a twist every time he has the hood up. The best results are attained when it is possible to turn the fan with considerable resistance, but not to spin it. If a quick twist of the fan is followed by a little turning after the hand is removed, then the belt is too loose. Do not have it any tighter than necessary, for then it is under

excessive strain, and will stretch, wear, or break the sooner.

Do not neglect to change the oil in the crank-case because it is a dirty job. The car manufacturer knows when it should be changed, and his advice should always be carefully followed. If you could visit a repair shop and see a few engines that have suffered from neglect, you would be more careful of your own.

Trouble is often experienced in getting the tread to stick on small tire repairs. This may be due to anyone of several reasons,

the most common of which is that the cement has been applied over wet fabric. The moisture in the fabric, even if very slight, will blow the tread loose. Another common cause for loose treads is the failure to roughen up the old carcass sufficiently. In this case the cement will not hold properly, and after a few miles of running the repair will separate. It is also well to make sure that proper pressure is being applied to the repair when it is curing, so that the patch will be thoroughly embedded in the tire.

Things You Should Know About Paint-Brushes

By John Henry Coon

WITH everything else so high in price, it is not surprising to find a good paint or varnish brush costing double what it did a few years ago. It is surprising, though, to find, even among otherwise clever painters, a woeful lack of knowledge in the care of brushes. More brushes are ruined than are ever worn out, in spite of the fact that it is such a simple matter to take proper care of them.

Two don'ts, carefully observed, will overcome the greatest mistakes made in taking care of brushes.

Don't keep your brushes in water.

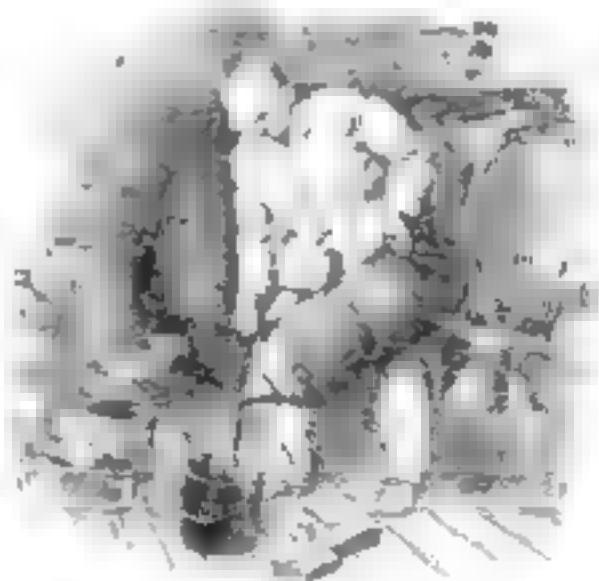
Don't let them stand on their bristle end in whatever liquid you keep them.

Bristles have a little tube or capillary for a great part of their length, and quickly saturate themselves with water when put into it. A water-soaked brush is flabby and lifeless, and you cannot "rub paint in" with a brush in

this condition. Some painters contend that when a brush is well soaked up with paint, water won't hurt it; but working two brushes side by side, one kept in water and the other properly kept, will soon disprove this contention.

If you want your brushes to work well and work longer, suspend them in raw linseed oil to a depth of at least half an inch above the bottom of the ferrule if metal bound, or of the strap if leather bound. This will not only keep the bristles springy and elastic, but will tend to keep your brushes clean and prevent their

getting "lousy" at the heel. The oil will loosen the paint pigments from the brushes, which will be carried to the bottom. The oil must come above the bottom of the band or strap, however; otherwise the brush, by constantly drying at the heel, will lose one advantage of proper suspension.



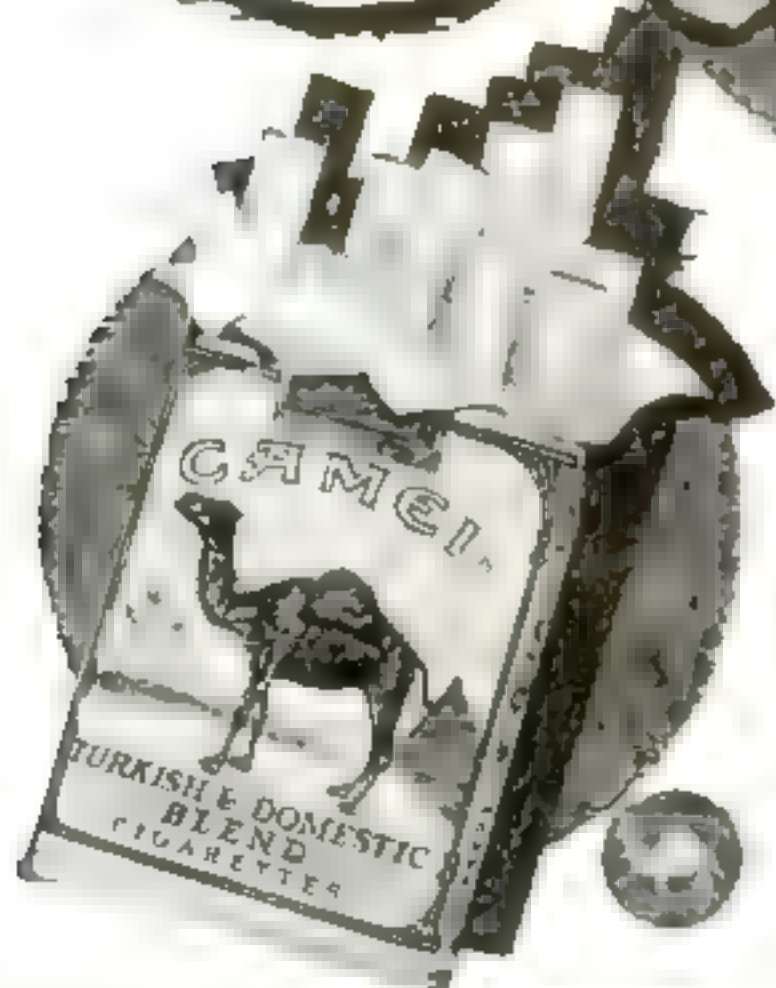
Treat your paint-brushes with consideration and they will repay you with long service.

As sure as you
are a foot high

you will like this
Camel Turkish and
Domestic blend!

Camel

CIGARETTES



Camels are sold everywhere in
scientifically sealed packages of
20 cigarettes for 20 cents or two
packages 200 cigarettes in a
glassine paper-covered carton.
We strongly recommend this
carton for the home or office sup-
ply or when you travel.

R. J. Reynolds Tobacco Co.
Winston-Salem, N. C.

YOU will prefer Camels smooth, de-
lightful blend of choice Turkish and
choice Domestic tobaccos to *either kind
smoked straight!* It gives you an en-
tirely new idea of cigarette enjoyment.

Camels never tire your taste no matter
how liberally you smoke. They are al-
ways appetizing—and satisfying, because
they have a desirable, mellow body.

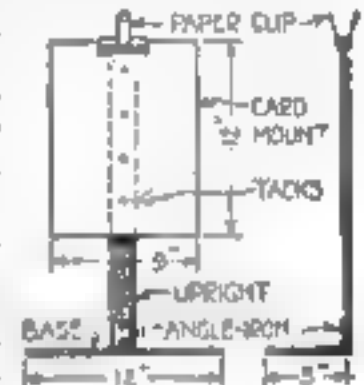
Camels leave no unpleasant cigaretty
aftertaste nor unpleasant cigaretty odor.
In fact, every angle you get on Camels is
so different from any other cigarette that
you will be won as you were never won
before!

That's why we say frankly—*compare
Camels with any cigarette in the world
at any price!* We know the answer.

How to Make a Cheap but Excellent Copy-Holder

THE typewriter has come into such extensive use by all classes of people that an added interest attaches to any device which allows the typist to turn out more work with less expense and fatigue. In copying, the typist usually lays the copy down on a table alongside of the machine, glancing down, from time to time, at the text. This results in a slowing down of the work, since the operator's eyes are taken from the printing point of the machine to the text upon the table.

The manuscript is harder to read in a horizontal than in a vertical position. By using the simple little instrument devised by the writer, the printing point and text are



The copy-holder ready for use and the dimensions necessary for making it

close together, so that the eyes need be moved only a short distance. The materials are few and cheap; they consist of one 9-by-12-in. photographic card mount; a box of upholsterer's tacks $\frac{1}{4}$ in. long, one paper clip, one yard-stick, a piece of wood 12 in. long, 5 in. wide, and $\frac{1}{4}$ in. thick; one angle-iron brace having legs $1\frac{1}{2}$ in. long, $\frac{1}{2}$ in. wide, and $\frac{1}{2}$ in. thick, one dozen $\frac{1}{4}$ in. flat-head wood screws; a can of paint and a brush.

The angle-iron, screws, paint and brush, and the clip may be bought very cheaply. Cut the yard-stick or a piece of wood of similar thickness and width to 18 in., and tack it lengthwise in the center and parallel to the long side of the card, allowing the latter to project one inch above the end of the stick. Screw the leg of the angle-iron to one end of the yard-stick; the other leg is to be fastened in the center of the 12-in. piece.

Make sure that no mechanism on the under side of the typewriter touches the board. If it does, cut a slot in the wood to allow the part to work freely.

After the instrument is constructed, paint it all over, as otherwise the card will absorb moisture from the air and bend. If desired, the base-board could be made out of thicker wood, such as $\frac{3}{4}$ -in. instead of $\frac{1}{4}$ -in. material. In this case, it is not necessary to have the rear legs of the typewriter rest upon the board, but the appliance may be placed behind the machine, leaving sufficient space for the paper to clear it.

The length of 18 in. for the card-holding stick is made to take paper $8\frac{1}{2}$ by $13\frac{1}{2}$ in. in size. For shorter paper, the stick may be made 15 in. long. W. S. STANDIFORD.

Sharpen It Up Yourself!

In 5 Minutes For 5 Cents

No need of sending your mower away every so often and paying \$1 and \$2 to have the blades filed. A 50c. can of Clover Lawn Mower Sharpening Compound will make any mower cut like new all season long. Enough in the can to sharpen one mower 10 times or 10 mowers once.



1. First time blade is not over a month or possible with each new blade in winter length. Don't let too tightly together.

No Experience Necessary No Need to Take Mower Apart Satisfaction Absolutely Guaranteed

Read the directions and see how easy it is done. No removing blades. Apply Clover push mower and with the rotating and hand blades are sharpened together as easy as mowing a small patch of grass.

The Clover way is the only proper method of sharpening a dull mower. It is economical, saves time and trouble—makes grass cutting a joy all summer long.

Clover also sharpens power mowers, horse clipper, hedge shears, feed cutters, lawn shears, edgers and pruning shears.

Ask your hardware dealer for Clover Lawn Mower Sharpening Compound. If he cannot supply you, send us his name and money, order for one, and we will send you, post paid, a full sized can of Clover compound for a winter's use. Delivery guaranteed.

Full instructions with each can.



2. Push the mower for first and last cutting in winter. In winter and spring, sharpen the blades and grinding them together.



3. Apply Clover Compound entire length of each riding blade with finger tip.



4. Rub off compound blades with a rag. Mower will stay sharp all winter and spring without need of grinding.

BOYS: Last year boys earned \$5 to \$8 per week sharpening mowers after school. Join Mike Clover's Klean Kut Klub for boys. Every member who earns \$5 or more sharpening mowers, receives a handsome 3-bladed jack-knife. Send a postal for interesting details.

Clover Mfg. Company

201 MAIN STREET
NORWALK, CONN.

CHICAGO BRANCH: 807 West Adams Street
SAN FRANCISCO BRANCH: 555 Howard Street

Makers of the
Famous Clover Leaf Valve
Grinding Compound

MAIL THE COUPON

CLOVER MFG. COMPANY,
201 Main St., Norwalk, Conn.

Enclosed find 50c. money order for which send me one full-sized can of Clover Lawn Mower Sharpening Compound, delivery guaranteed to my address.

Print Dealer's Name

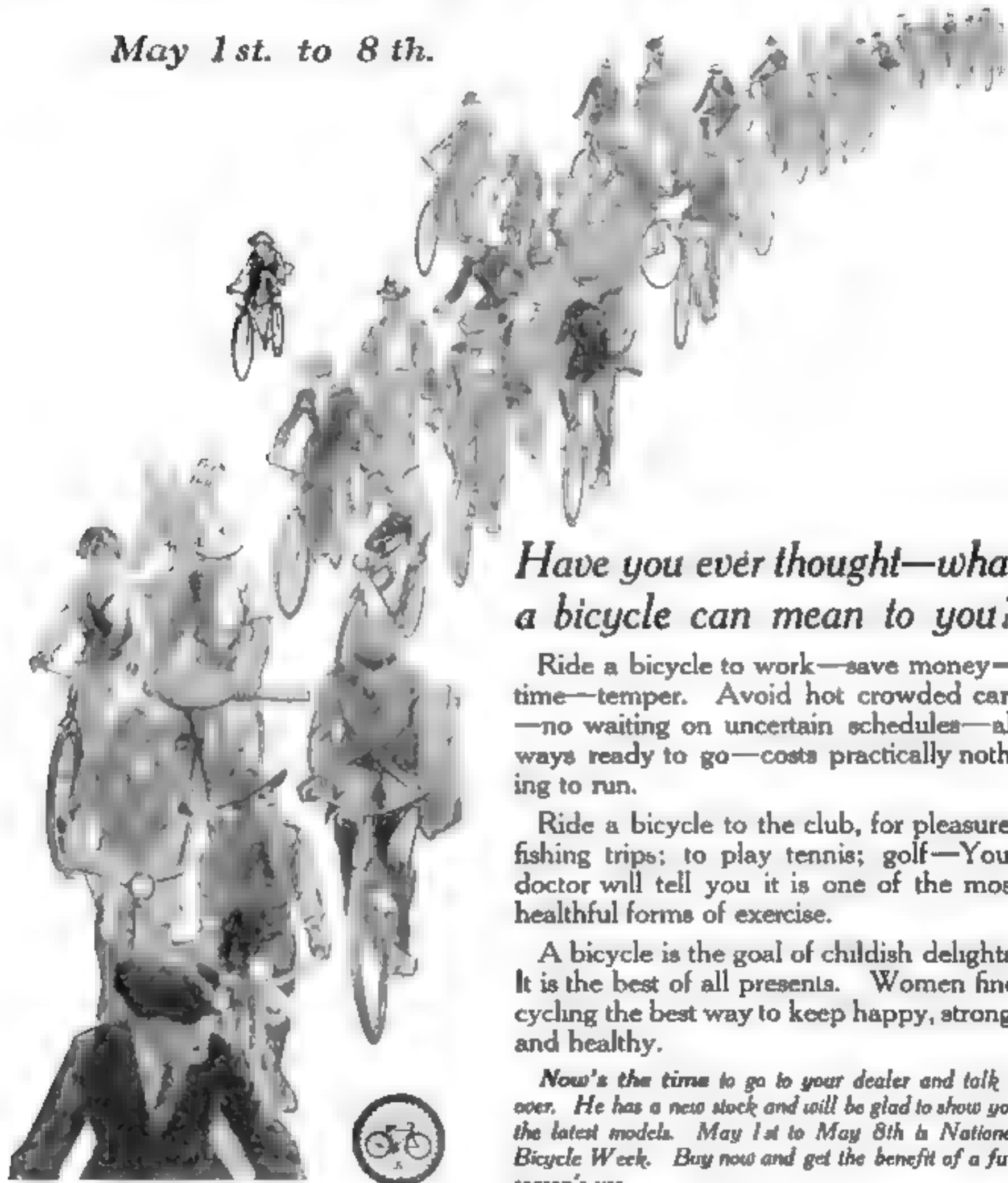
Print Dealer's Address

Print Your Name

Print Your Address

NATIONAL BICYCLE WEEK

May 1st. to 8th.



Have you ever thought—what a bicycle can mean to you?

Ride a bicycle to work—save money—time—temper. Avoid hot crowded cars—no waiting on uncertain schedules—always ready to go—costs practically nothing to run.

Ride a bicycle to the club, for pleasure; fishing trips; to play tennis; golf—Your doctor will tell you it is one of the most healthful forms of exercise.

A bicycle is the goal of childish delights. It is the best of all presents. Women find cycling the best way to keep happy, strong, and healthy.

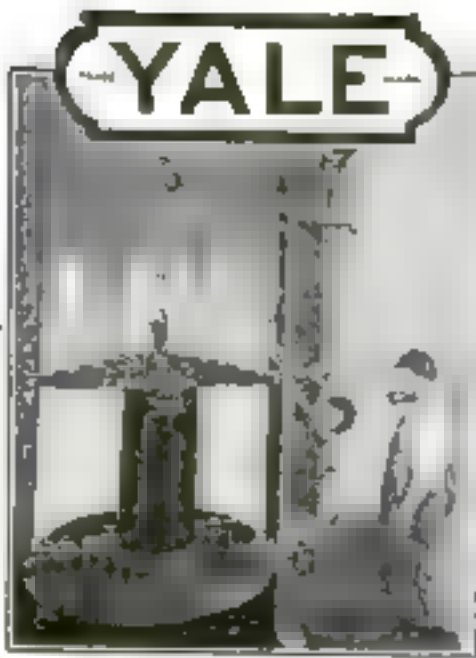
Now's the time to go to your dealer and talk it over. He has a new stock and will be glad to show you the latest models. May 1st to May 8th is National Bicycle Week. Buy now and get the benefit of a full season's use.

Ride a Bicycle

CYCLE TRADES OF AMERICA, Inc., 35 Warren Street

New York, U. S. A.

YALE



Testing a One-Ton Yale Spur-Gear Chain Block

Safety is Certified in Every Yale Chain Block

EACH Yale Chain block must lift a test load 50% over its rated capacity before it can leave the factory.

That means certified safety, safety that warrants confidence in the Yale Chain Block as the safest block for every hoisting need.

For complete information regarding the Yale Spur-Gear Block, Yale Screw-Gear Block, Yale Differential Chain Block, and Electric Hoists, ask for our new 1913 catalog.

For a Factory locking system use the Yale Masterkey System

Write for particulars

The Yale & Towne Mfg. Co.
Makers of the Yale Locks

Works and General Offices
Stamford, Conn.

New York Office: 9 East 40th Street
Chicago Office: 27 East Lake Street
Canadian Yale & Towne Ltd.,
St. Catharines, Ont.

Putting speed, power and safety in handling parts to and from machines with the Yale Spur-Gear Chain Block



This Contest Still Open

\$5,000 Scholarship Fund, to be awarded by a committee of three distinguished educators

THE ten scholarships of \$500 each that are to be awarded to high school students this spring by the POPULAR SCIENCE MONTHLY are under the control of a committee of educators of national reputation. The POPULAR SCIENCE MONTHLY takes pleasure in announcing that the committee will consist of:

Professor JOHN F. WOODHULL, Professor of Physics,
Teachers College, Columbia University

Professor ALFRED E. BURTON, Dean, Massachusetts
Institute of Technology

Dr. C. R. MANN, Chairman Advisory Educational
Committee, U. S. Army

As announced in previous issues, the POPULAR SCIENCE MONTHLY will award to high school students, at the close of the present school year, ten scholarships of \$500 each. The winners may select any college or technical school in the United States that they may wish to attend.

The purpose of the Scholarship Contest is to arouse interest among students in the practical application of their school work to the new mechanical and scientific improvements, inventions, and discoveries.

The Scholarship Committee believes, with the POPULAR SCIENCE MONTHLY, that we are entering upon a period of marvelous developments in which scientific discovery and invention will play an important part.

Examination Based on the May Issue

The Scholarship Committee, because of the widespread interest in this contest, has decided to simplify the rules. The modified conditions are as follows:

1. The scholarships will be awarded as a result of a competitive examination based on the new applications of science that are found in the May issue of the POPULAR SCIENCE MONTHLY.

2. The contest is open to any high school student.

3. The examination will be held in the candidate's own school on June 2, 1913.

4. Any school that has pupils who wish to compete should make application of the question papers on or before May 15.

Any student who has made himself familiar with the new inventions described in this issue is well equipped to try for the \$500 prize.

The POPULAR SCIENCE MONTHLY supplies teachers, for their use in class-room work, with Teachers' Service Sheets, which classify all the important new applications of science in each issue of this magazine. The Teachers' Service Sheets are supplied free of charge to any school that uses the POPULAR SCIENCE MONTHLY in connection with the work of the science classes.

Service Sheets classifying all the important subjects in the May issue have been prepared, and will be sent to any teacher upon application. To prepare for the examination get your teacher to write us for a copy of the May Service Sheets and to enroll your name for the examination.

Each student who takes the examination will be competing only with students who live in the same part of

the country. One \$500 scholarship will be awarded to the student passing the best examination in each of the following groups of States:

NEW ENGLAND GROUP: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

NEW YORK GROUP: New York City and State.

NEW JERSEY AND PENNSYLVANIA GROUP: New Jersey and Pennsylvania.

MID-ATLANTIC GROUP: Delaware, Maryland, Virginia, West Virginia, Kentucky, Tennessee.

SOUTH ATLANTIC GROUP: North Carolina, South Carolina, Georgia, Alabama, Florida, Porto Rico.

GREAT LAKES GROUP: Ohio, Indiana, Michigan.

CENTRAL GROUP: Illinois, Wisconsin, Minnesota.

PRAIRIE GROUP: Iowa, Missouri, Kansas, Nebraska, South Dakota, North Dakota.

SOUTH CENTRAL GROUP: Arkansas, Mississippi, Louisiana, Oklahoma, Texas.

WESTERN GROUP: Wyoming, Montana, Colorado, New Mexico, Idaho, Utah, Arizona, Washington, Oregon, Nevada, California, Hawaiian Islands.

SCHOLARSHIP COMMITTEE

POPULAR SCIENCE MONTHLY

225 West 39th Street, New York

Mechanical friction reduced to an absolute minimum

The motorcycle world finds its fondest dreams realized in the INDIAN Scout. A sum of the reasons "how and why" would fill a book, but very prominent among them stands the almost unbelievable friction reduction achieved by the Scout construction.

In the INDIAN Scout, the connecting rods, driving shaft, piston shaft, and intermediate gear of transmission are borne on roller bearings. Clutch and three speed main shaft are carried by large sized annular ball bearings. Front and rear hub are equipped with cup and cone type ball bearings of large size.

Whatever the type, only the highest test bearings go into the INDIAN machine.

The finest ball and roller bearings obtainable guard the working parts of the INDIAN Scout against friction-wear and power-waste.

Unusual advantages to the INDIAN rider result from this scientific, mechanical nimbleness. In addition to a wealth of riding ease, these friction-reducers give increased mileage per gallon of fuel and long service-life to every working part.

Department 38

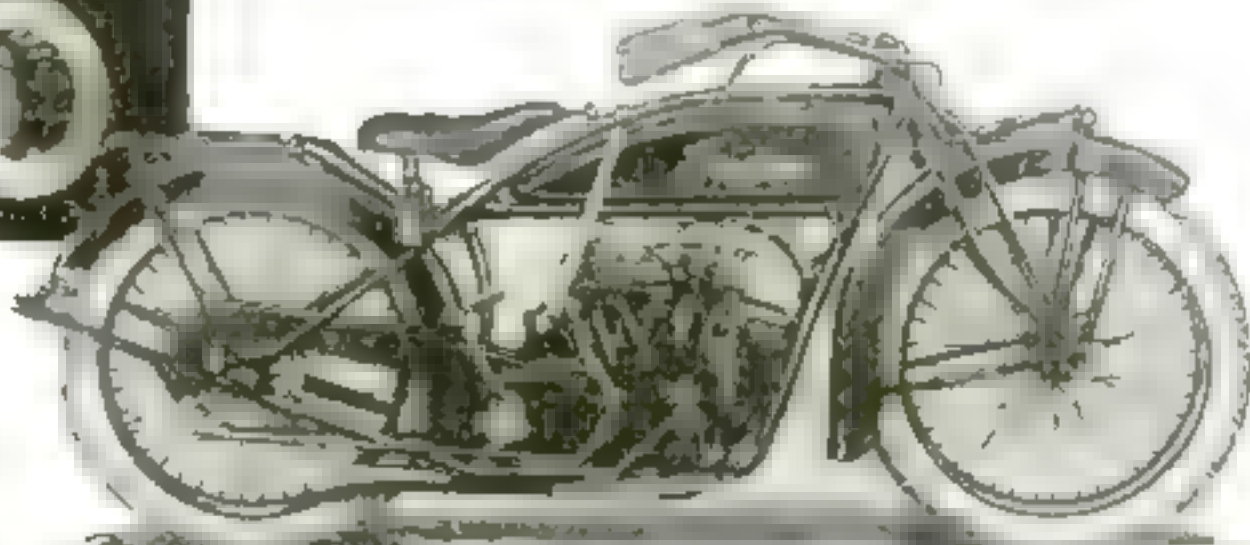
HENDEE MANUFACTURING COMPANY

Springfield, Mass.

The Largest Motorcycle Manufacturer in the World



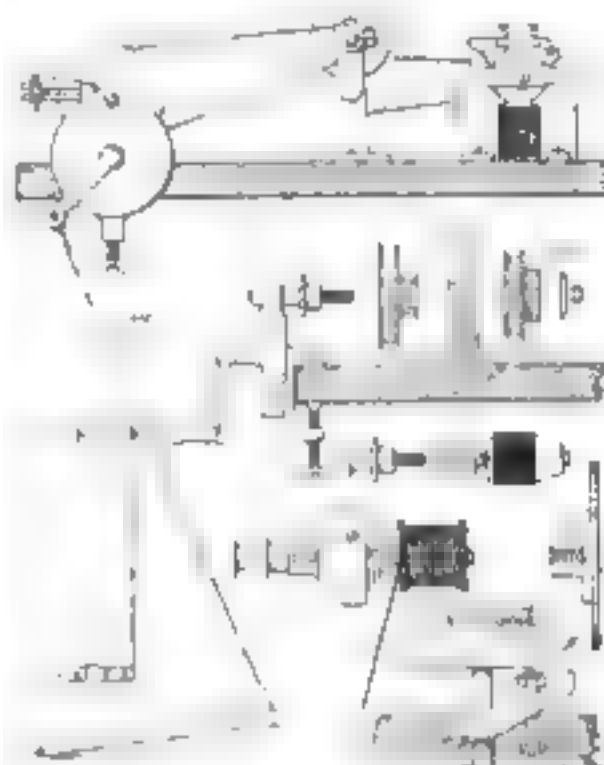
INDIAN Scout
Model G20



Indian Motorcycle
For Sale by Dealers Everywhere

The Utility of the Hand-Power Grinder

BESIDES running a regular grinding wheel for sharpening tools, a small hand-power bench grinder may be adapted to a large variety of other uses in the home or small shop, especially when no lathe is at hand. By removing the grinding wheel, different



The small hand power bench grinder may be adapted to a variety of other uses, such as attaching to a small dynamo or a light machine

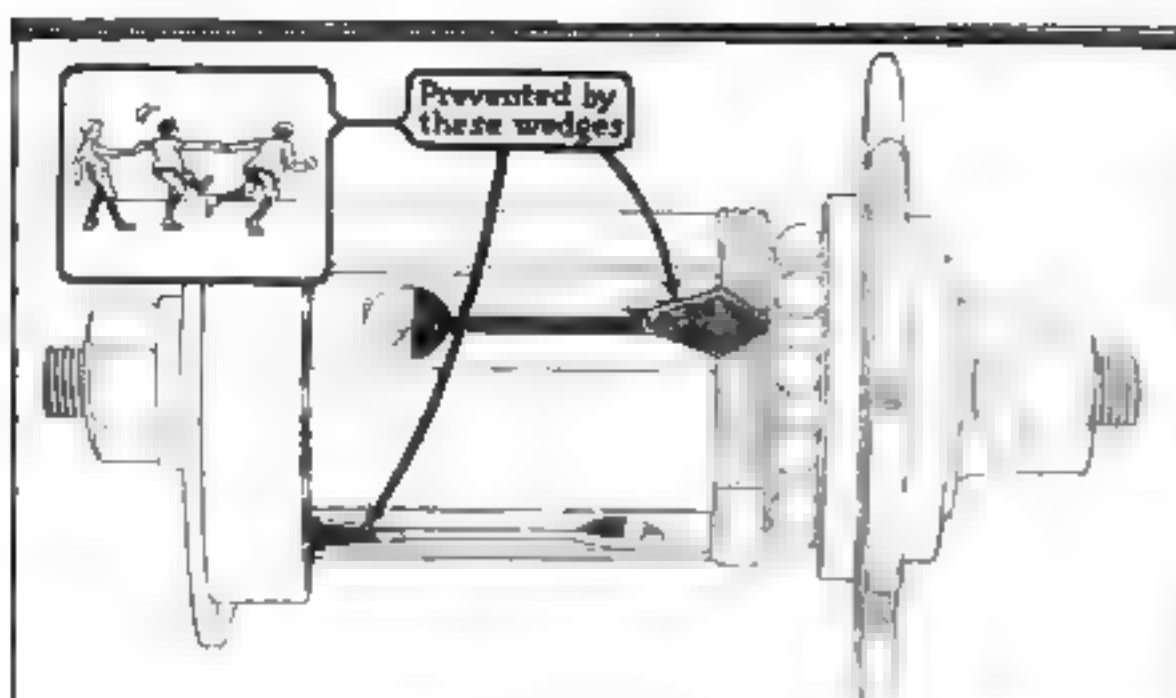
sizes of pulleys may be clamped on the spindle in its place. In the illustration, at A, B, and C are shown a grooved two-step wooden pulley, a crowned face pulley for a flat leather belt, and a single grooved pulley with a wood packing disk.

Such pulleys can be turned to shape by first cutting a hardwood block to a roughly octagonal form, boring to fit the grinder boss, clamping to the spindle, and then rigging up a work-rest something like that shown at D, which is clamped or bolted to the bench alongside of the grinder and is used the same as the work-rest of a lathe.

To make the device still further resemble a foot-lathe, a light wooden treadle, E, can be rigged up as shown. It is hinged to the floor and connected to the crank handle by a leather strap. Only a light foot pressure should be applied, however, or the handle will be bent or broken.

A pulley fitted in place of the grinding wheel will serve to drive light machinery requiring only an intermittent application of power. Sometimes it is desired to drive a light-power grinding stand, as at F, in order to obtain an increased speed or to obtain the benefit of special buffing or other equipment furnished by the power grinder. Another application is the driving of a small dynamo, as at G.

At H is a coupling turned up from a piece of cold-rolled steel, tapped at



Side-Swing Eliminated

This simple illustration shows a splendid reason why your bicycle should have a

Morrow STURDY-SURE COASTER BRAKE

7 Reasons for the Morrow

1. Braking surface 6 1/2 in. in. — much larger than other brakes.
2. Hub expansion forced equally by two wedges at each end — resulting even braking distribution over entire hub surface.
3. Rim brake shoes being inflated three times over — nine surfaces, 18 in. in. in. by, demerol, sure.
4. For forward pedaling the Morrow responds instantly and positively.
5. More safe bearings than other brakes, no wheel rim wear.
6. The Morrow is strong and sturdy, yet light, hand held.
7. Many day's operation, followed by a final long, quiet, perfect service.

Imagine three boys holding hands and running. Suppose the boy at one end should stop and the one at the other kept running. The boy between would get a mighty sharp jerk sideways, wouldn't he?

This is exactly what happens in a coaster brake if the braking power is unevenly distributed. When you attempt to stop with such a brake one end of the hub is controlled and checked, but the other end tends to keep going. From this, twists "side-swings" (which lead to loosened spokes) result.

Uneven riding and "side-swings" have been completely eliminated in the MORROW Coaster Brake. An expanding "Morrow" of spring steel extends practically the full length of the MORROW hub. When you back pedal, four wedges, two acting from each end are driven into the "Morrow" and expand it equally and evenly, thereby distributing the braking power over the entire inner surface of the hub.

"Ride a Bicycle"



ECLIPSE MACHINE COMPANY
ELMIRA, NEW YORK



Demand the MORROW on the next Bicycle you Buy

Quality First

Boston Garter

GEORGE FROST COMPANY MAKERS BOSTON

SAVE 25% to 60%

on all GRAFLEX KODAKS

Complete and complete of every description. Equal to any other camera. Write for Free Catalogue and Catalogue. Selling hundreds of cameras every day. In every part of the world. Write for Free Catalogue. All goods sold on 30 days. Free Trial. Money back if not satisfied. You can see them at the Central Camera Co. 124 West 4th St. New York City.

CENTRAL CAMERA CO.
Dept. 10, 124 West 4th St., New York City

AGENTS: \$50 a Week

Brand New Guaranteed Shoe Proposition

For men, women and children. Must wear and give satisfaction or replaced free. All pairs \$1.00. Good for 1 and better than leather. Free size arch shank. A or street every home. On a table order for 3 or 4 pairs in the family. Know it's it make you a steady customer.

Work Spare Time or Full Time

As, men, women, young or old can make big money this proposition. No capital required. Write for Agency. Be first in your territory to handle this guaranteed shoe.

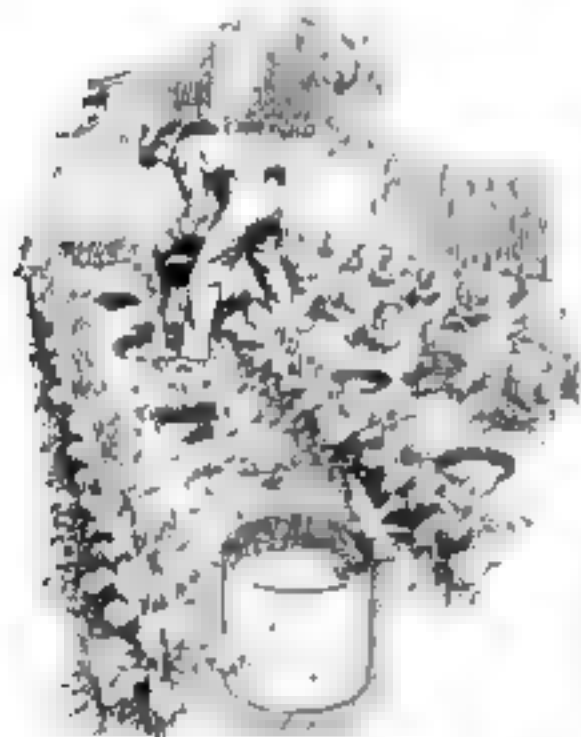
Thomas Shoe Co., 247 Long St., Dayton, Ohio

one end to fit the grinder spindle, and turned down and threaded at the other to take a chuck from a hand or breast drill. A small flange is shown at *I* and *J*, also drilled and tapped to screw on the spindle. A 2- or 3-in. universal chuck is fitted to the flange, and either this or the drill-chuck will hold drills or small pieces for polishing or filing.

A wooden or metal rod with a piece of abrasive cloth glued around it, *K*, is a useful device when held in the chuck. Another important use is to hold a magnet core or spool for the coil winding. *L*. *J* shows a disk grinder—a brass or iron or even a hardwood disk screwed to the flange and a disk of abrasive cloth glued to its face. This will prove to be a very useful piece of equipment. A second disk could also be constructed and sandpaper glued to it for finishing small patterns and other woodwork.—H. H. PARKER.

An Underground Irrigation System for the Garden

IF the garden plot is not large and one has access to an old tin can pile, no fears need result from continued dry spells, according to the plan of an ingenious farmer. He amassed a lot of half-gallon and gallon cans from such a pile, perforated them with



No need to worry about dry spells if your garden is equipped with old tin cans punched full of holes

small nail-holes, pried the holes, and sunk each can to the level of the ground between rows of garden stuff.

When the cans were filled with water, the moisture reached the roots of the plants by a direct, businesslike route. A gallon of water, this thoughtful person found, went three times as far, when administered in this fashion, as when poured on in the usual way. Figuring out the profits, it was found that each minute thus spent was worth three ears of corn, half a head of cabbage, eleven radishes, and two turnips.—DALE VAN HORN



6,000 More People

Every Day Start Saving Teeth in This Way

All Statements Approved by High Dental Authorities

There is a new scientific tooth paste used on millions of teeth today. You see them everywhere—glittering teeth, conspicuous for their beauty.

Leading dentists all over America are urging its daily use. Over 6,000 people daily on the average write us for a trial tube.

Soon or late all careful people are bound to join these users. But that is to urge you to learn at once what this new method means.

To End the Film

The purpose is to end the film—that viscous film which rots the teeth and causes most tooth troubles.

You can feel this film. It clings to teeth, enters crevices and stays. The ordinary tooth paste does not dissolve it. The tooth brush does not end it. So

month after month it remains there, causing stain and tartar and decay.

Film is what discolours—not the teeth. It is the basis of tartar. It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea. All these troubles are constantly increasing, despite the wide use of the tooth brush. And film is the major reason.

Dental science, after years of searching, has found a way to combat film. Able authorities have proved its efficiency by countless careful tests.

It is now embodied in a dentifrice called Pepsodent—a tooth paste which meets every dental requirement. And a 10-Day Tube is being offered to let everyone see what it does.

Watch Your Teeth Whiten

Get this free tube and let your mirror show you Pepsodent effects.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

A new discovery has made pepsin possible. Pepsin must be activated, and the usual agent is an acid harmful to the teeth. But science has now found a harmless activating method. And now

this efficient film combatant can be every day applied.

Send the coupon for a 10-Day Tube. Note how clean the tooth feel after using. Mark the absence of the viscous film. See how the teeth whiten as fixed film disappears.

Compare this new-day method with the old. Then let the clear results decide what is best for you and yours. Cut out the coupon now.

Pepsodent
REG. U.S. PAT. OFF.

The New-Day Dentifrice

The scientific film combatant, now advised by leading dentists everywhere and supplied by druggists in large tubes.

10-Day Tube Free
THE PEPSODENT COMPANY,
Dept. 363, 1104 S. Wabash Ave.,
Chicago, Ill.

Mail 10-Day Tube of Pepsodent to

Only one tube in a family

How to Make an Extension Bench Light

ONE good use for old pipe and fittings is that of making a bench-vise extension bracket light, as shown in the illustration. The construction is simple.

A bracket shaped as shown is made for holding it to the wall, a pivot stud



Use up old pipe fittings by making an adjustable bench light. It can be pulled to any part of the bench desired.

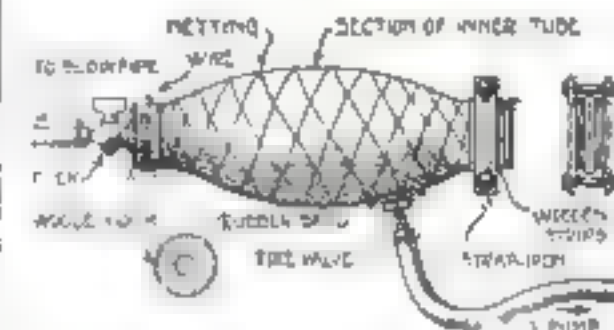
being screwed in the one lug, over which the bent end of the pipe sets. The first section of the bracket pipe has a hole drilled at the bend to permit the electric cord being inserted inside the pipe. The rest of the extension bracket is made up of short lengths of pipe and old elbows. On the last elbow the electric-light socket is screwed.

Each elbow is pinned at one part to prevent undue looseness and downward movement.—CHARLES H. WILLEY

A Pressure Apparatus for the Gas Blowpipe

A GAS blowpipe requires air under slight pressure, and a simple and inexpensive way to obtain this pressure, and to maintain it steadily, is shown in the accompanying sketch.

Arrange a foot-pump—an ordinary tire-pump—to deliver air to a bag made of a section of an old inner tube, about 2 ft. of the tube will be enough. Close up one end tightly, cementing the rubber and holding the edges firmly together with two strips of



The old automobile inner tube acting as an air container for a gas blowpipe.

wood clamped with screws, as shown. Connect the air hose from the pump to the tire-valve.

For the other end of the air-bag, cut a disk of wood large enough so that the

IVER JOHNSON SAFETY-AUTOMATIC REVOLVER



Are You Prepared to Meet Prowlers?

"I was returning home late one night and fortunately had an Iver Johnson revolver in my lap pocket. Reaching home I discovered a pair of prowlers attempting to slip out the back way. I gave chase through an alley for two blocks, overhauling one of them, and from that one I learned the name of the other one, whom I interviewed the following day. Had I not been armed, I could not have gone up against them. —C. A. HUTCHINPILLAR, IRONTON, OHIO.

...

The Iver Johnson is always dependable. And it can't go off by accident. Drop it, thump it, or "Hammer the Hammer." Draw-tempered piano-wire springs throughout make the Iver Johnson alert, ready for use on an instant's notice.

Choice of three grips: Regular, Perfect Rubber, Western Walnut. Three Booklets, One of All Free on Request:

"A"—Arms "B"—Bicycles "C"—Motorcycles

If your dealer hasn't the book the particular model you want, send to his name and address. We will gladly pay through him.

Iver Johnson's Arms & Cycle Works

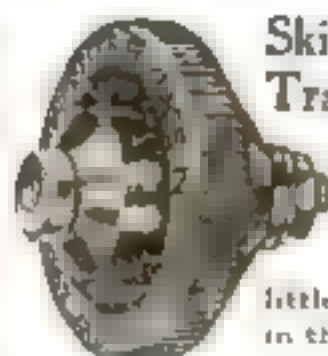
343 River Street, Elmhurst, Mass.

14 Chambers St., New York 37 Market St., San Francisco



Iver Johnson Single and Double Barrel Revolvers are the most accurate and dependable.

Iver Johnson
"Superior"
Revolver
Single to \$10.00
Double to \$12.00
to \$15.00
No extra charge
for Coaster
Grips.



Skinderviken Transmitter Button

The most efficient little transmitter in the world.

Over 15,000 Sold in Less Than a Year. Use it on your phonograph, wireless, or any other electric device. It is the most efficient of all.

Make Your Own Detectivephone. Send \$1.00 for one Button with free descriptive booklet and circuit diagrams. Order now from

J. SKINDERVIKEN

135 E. Broadway, New York City
or 184 W. Randolph St., Chicago, Ill.

SAVE 1/2



Your "GAS" and ALL Your Trouble 15-DAY FREE TRIAL Money-back Guarantee

Entirely NEW principle—not a moving part. Simple. Has the Pop and Power.

U. & J. Carburetor

Double Mileage—Guaranteed to start car in zero weather. No Priming. 50,000 delighted users. Now ready for Ford, Dodge, Maxwell and Overland. DEALERS Service Stations Everywhere. The "U. & J." will on demonstration installed in thirty minutes—come and see our territory.

We also manufacture the U. & J. FORD TUNER. Will last as long as the car. PRICE \$1.50

U. & J. CARBURETOR CO. Dept. 231 301 W. Jackson Blvd. CHICAGO

tube will have to be stretched a little to go over it. Cut two rings from the tube, each as wide as the disk is thick. Give the edge of the disk two or three coats of rubber cement, and before the last coat is dry put one of the rubber rings on. Coat the outside of the ring with cement and place the tube over it. Finally, slip the other ring over the outside of the tube and bind it in place with insulated copper wire, such as ordinary bell wire.

Put an air-regulating valve in the disk, in which a hole has been drilled of the right size for the valve to screw into tightly; an ordinary gas-burner cock is as good as anything. Run a rubber pipe from this to the blowpipe. It makes a much better job if the bag is enclosed in netting, or even in a cotton envelope, which will allow it to expand to about twice its normal diameter, but will prevent its bursting. If the tube is old and rather deteriorated, do not allow it to expand to more than one and a half times its original diameter.

A foot-power arrangement may be applied if desired, and it is a great convenience, leaving both hands free all the time.—R. PRINDLE.

To Prevent Water Running Beneath Window-Sills

UNLESS steps are taken to prevent it, rain water often runs back under cornices or window-sills, and from there down the sides or walls of the building.



GROOVE AT LEAST 1/2 INCH RADIUS

Here is a way to keep water from running down the sides of your house

This may be prevented by grooving the under side of the sill in the manner shown

in the illustration. Try it and you will be rid of this nuisance.—ROY POSTON.

Why Mismatched Bolts and Nuts Become Loose

AN experienced mechanic sometimes will force a nut on to a bolt, even if the threads do not match, and in such cases the nut seldom stays on. The cause of the trouble will be made plain by a reference to the illustration on page 112, in which the threads are shown farther apart on the bolt than on the nut member.

If the threads touch one another at the second turn from the entrance to the nut, then at the third turn they will be slightly out of contact, and still more so at the next turn. The strain is practically at a single point instead of being evenly distributed along the bolt. As the strain is often very great, the threads are simply stripped off, and a rupture occurs.

That is why a nut does not stay on if it does not match the bolt. The man

Dayton Bicycles



You'll Think You're Young

REAL bicycling days again! The open road—swift, smooth flight—rushing air—tingling pulse—flying heels—glistening wheels! If you're not you'll think you are

A bicycle is the healthiest, cheapest, most convenient and most dependable form of transportation ever devised. Think what it would mean to

that boy and to you. In quality, design and workmanship, Dayton Bicycles have been leaders for 25 years.

Ride a bicycle—ride a Dayton

Write today for your dealer's name and catalog No. 44 showing 8 fine, new 1920 Dayton Models for men, women, boys and girls.

Cycle Dept., THE DAVIS SEWING MACHINE CO., Dayton, Ohio

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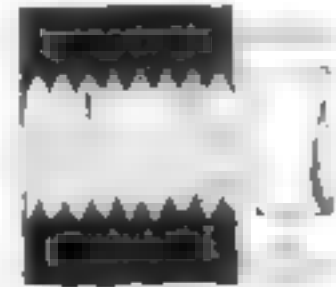
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who is in a hurry and thinks that he saves time by forcing together the first bolt and nut that are at hand is often wrong, and sometimes a breakdown results. Standardizing threads is a subject that has been studied from the points of view of the engineering societies, of the makers of nuts and bolts, and of the users, with the result that much progress has been made.



When the threads do not match, don't force the nut on the bolt

Here's a Paint and Varnish Remover

A PINT bottle or can containing equal parts of benzol and denatured alcohol is a good thing to have around the house, in the workshop, and in the garage.

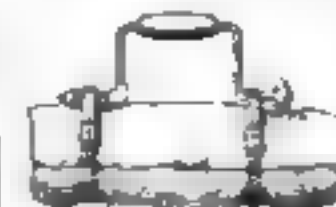
Primarily it is a paint and varnish remover. Applied with a clean brush to a painted or varnished surface, and allowed to remain five or ten minutes, it will eat down to the bare wood and give very good results.

Nothing can equal this mixture as a remover of spots of all kinds from clothing. It may be used safely on any kind of fabric, including silk and taffeta, without injuring the texture, and it will not leave any mark.

It can be used very effectively in the garage because it is unsurpassed for cleaning metal parts that are mud- and oil-crusts, and for removing grease and oil stains from tires. It is also an excellent carbon remover. Simply pour an ounce in each cylinder when the engine is cold, allow it to stand from two to twelve hours, and then start the engine, whereupon the loosened carbon will be blown out of the exhaust in powder form.—J. E. DURST.

A Substitute Handle for the Tool-Kit

AS a rule, a carpenter straps all his tools into a bundle and, for lack of a suitable handle, carries them under his arm.



Bundle of tools

Why carry a bundle of tools under your arm, when the brace makes a very suitable handle?

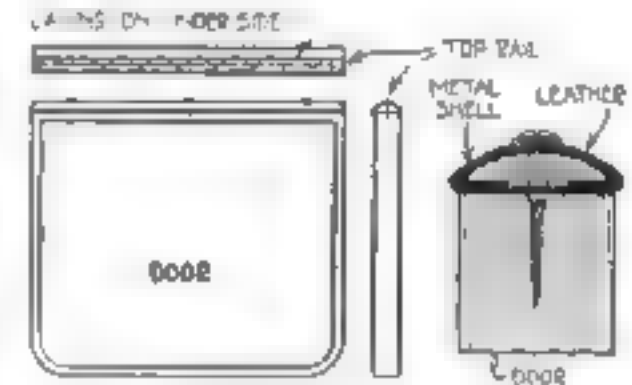
A convenient handle for carrying a bundle of tools may be provided by strapping the brace to the outside. It gives a good grip, is comfortable to hold, and it does not add anything to be carried.

The heavier the bundle, the more such an improvised handle will be appreciated.—HOWARD GREENE.

Cover Automobile Door Tops for Protection

CONSTRUCTION of automobile side doors usually embodies enameled steel top strips, which, because of their constant wear and tear in opening and closing the doors, causes the paint to wear off and the metal to rust. This is not only unsightly, but it is also a means of soiling the hands.

To overcome this nuisance, remove the top strips by taking out the



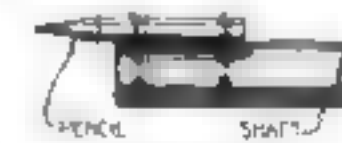
Save your hands and restore your door top's appearance by leather strips

screws, and cover them with thin strips of imitation leather. The bottom edges of the leather may be brought together by sewing with heavy shoe thread after the leather is placed around the metal strip. The result is a pleasing leather-covered door top. It will wear a long time before it needs recovering.

Try out this scheme, not only for the sake of your own comfort, but for the car's second-hand value. The prospective purchaser will judge the price by your car's outward appearance.—P. P. AVERY

Counting Revolutions by a Simple Method

TO ascertain the speed in revolutions a minute of a revolving shaft, attach a short pencil to the shaft in any convenient way, so that



1 LBS. IN WEIGHT OF PENCIL

The pencil revolving around the shaft records in loops on paper

it will turn with the shaft, but will not run true; the sketch shows the idea.

Tack a strip of paper to a smooth strip of wood. While the shaft is turning, hold the paper lightly against

the pencil, moving it slowly lengthwise. The pencil will make a series of loops on the paper. By counting the loops the number of revolutions can be obtained, and by taking the time required to make the loops the calculation can easily be made.

This method will not answer for shafts that turn at very high speed, but for moderate speeds it is very useful.



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“I was making \$15 a week and every penny of it was needed just to keep us going. It went on that way for several years—two or three small increases, but not enough to keep up with the rising cost of living. Then one day I woke up! I found I was not getting ahead simply because I had never learned to do anything in particular. As a result whenever an important promotion was to be made, I was passed by.

“I made up my mind right then to invest an hour after supper each night in my own future, so I wrote to Scranton and arranged for a course that would give me special training for our business. I can’t understand why I never realized before that this was the thing to do. Why, in a few months I had a whole new vision of my work! The general manager was about the first to note the change. An opening came and he gave me my first real chance—with an increase. A little later another promotion came with enough money so that we could save \$25 a month. Then another increase—I could put aside \$50 each pay day. And so it went.

“Today I am manager of my department—with two increases this year. We have a thousand dollars saved! And this is only the beginning. We are planning now for a home of our own. There will be new comforts for Rose, little enjoyments we have had to deny ourselves up to now. And there is a real future ahead with more money than I used to dare dream that I could make. What wonderful hours they are—those hours after supper!”

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An Adjustable Drop for the Shot-Gun Stock

AN experienced wing-shot says that the majority of amateur sportsmen fail to score hits in bird-shooting because they use guns having too much, or more often too little, "drop" of the stock. In covering the bird as it "gets up" they do not run their eye along the barrel, but more often see only the muzzle sight.

As a remedy for this fault, an adjustable stock is proposed, which by



The gun butt is dropped or raised to fit the long or short neck. The bolt then locks it.

actual tests has proved that hunters with records of poor shooting have been able to "get birds" as they never did before.

The provision of this adjustable stock requires the sawing off of the stock at the juncture of the "grip" and the butt. The saw-cut is made on a true circle of about two inches (or more) radius, as shown in the illustration. A hole for a $\frac{1}{4}$ -in. pin is drilled at the center of the circular saw-cut to receive a pin which engages the eye of a long eye-bolt, and a mortise is cut in the "grip" portion of the severed stock, large enough to receive the eye of the eye-bolt (which latter should be of $\frac{1}{2}$ -in. round rod).

The severed shoulder or butt portion of the stock is then bored and counterbored, as shown in the illustration, to receive the long eye-bolt, which, by the setting up of the locking nut, as shown, unites and locks the butt portion of the stock to the "grip" end at any desired degree of drop. The eye-bolt pin in the "grip" is reinforced by a U-shaped metal fitting, as a safeguard against splitting the stock.

Why Use a Step-Ladder to Change Light Bulbs?

IN replacing burnt-out electric-light bulbs it is usually necessary to use a step-ladder. Because a number of electric lights in a large church were hard to reach and necessitated the use of a very long ladder, the changer here described was made. It

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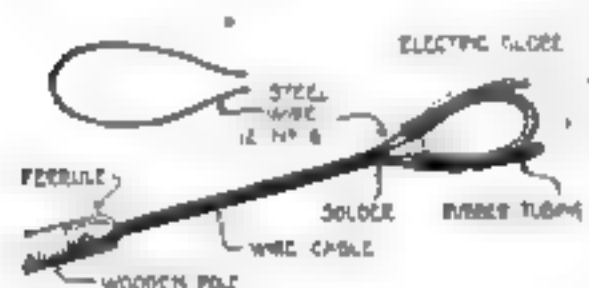
has proved to be such a convenience that others may be glad to know of it.

The changer is made of rubber-covered steel wire secured to a ferrule, and any length pole or handle may be used. It has no moving parts, and is readily self-adjusting for any light from a sixteen-watt to a hundred-watt light.

Rubber was found to be the only substance that would offer sufficient friction to grip the bulb firmly and yet leave no mark on the glass. Friction tape was first used, but it soon dried out and left a smear on the bulb, especially if it was warm.

The changer requires 6 ft. No. 16 steel wire, 4 ft. small thick-walled rubber hose with an inside diameter the same as the wire, a 7-in. length of steel wire cable of the cable clothes-line variety, and a small ferrule. The kind used came from an old buggy-shaft.

The steel wire was cut into foot lengths and bent into the shape shown. After drilling a hole in the end of the ferrule, one end of the cable was soldered to it. The wires were covered with the tubing, leaving two inches of the ends free. These



No step-ladder is necessary in using this electric-light bulb changer. It is made of rubber-covered steel wire.

were then soldered to the other end of the cable, completing the device. The base of the wire loops was built up with solder to insure against breaking out, and the whole finished off with a file. The wires were then bent into the form shown in the illustration.

Any suitable pole may be used for a handle. If the lights are in a 10- or 12-ft. ceiling, an ordinary broom-handle, cut off, will serve nicely. For halls and buildings that will require a longer handle, a bamboo pole will work well, and if the changer is to be used in various places, an old jointed fishing-pole will do, as it can be then used in almost any place.

The steel cable makes it possible to use the changer in ceilings or on walls, as it can be bent to fit over the light, and turned without difficulty.

Another important feature of the changer is that after the light has been unscrewed it can be lowered without danger of its falling out, since the rubber-coated wires grip it securely.

The materials for this changer cost about twenty-five cents, excluding the pole, and will be of value to anyone who is required to care for many lights.—DALE VAN HORN.



Banked Fires Draw No Interest

Eight o'clock at night about the busiest place you can find is an electric light and power plant. Boilers at full pressure, fires alive with energy, lights ablaze!

Eight o'clock in the morning it looks more like a country church on Thursday night. Every bit as animated.

A difference of only twelve hours—but it's all the difference between night load and day load.

Day load, when the big slump comes, is the great problem of the central station. With fires banked and generators silenced, the entire vast equipment is tied up in a production greatly reduced.

How to build up day load, so that the central station's resources may be utilized most efficiently, and the consumer himself benefit from the lower costs?

Not, obviously, by an increase in lighting. The solution lies in a greater daytime use of electric power.

Your morning cup of coffee made the electric way, your weekly ironing by electricity, your daily use of vacuum cleaner and portable utility motor are substantial aids in swelling day load.

Household appliances that are easy on the housewife and just as easy on the coal pile at the central station. For as the load rises the quantity of fuel needed in generating each additional unit of electricity becomes smaller. The plant operates with greater efficiency as it approaches capacity production.

So when the central station is campaigning for irons or grills or washing-machines we can be confident that its interest is not in making a few dollars from the sale.

Rather to reduce the disparity between day and night loads, to lower costs and to devote the savings to a service progressively more extensive.

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No. 5. Dotted all over the land in order to be near you are 43 Western Electric distributing houses, each bound by sentiment and business to its particular neighborhood. The branch in your own city stands ready to bring you personally or your call all the advantages of a localized national service.

Arrange it upright to a back-board, as shown in Fig. 1. Be sure it is perpendicular. Then swing one edge out toward the camera until the ground-glass shows an image like that which you wish to reproduce. Of course, the more you swing it edgewise to the lens the thinner the face will appear. On the other hand, do not swing it so far around as to make the near edge too much out of focus or so the light shines on the photograph in a way to reflect and obliterate the picture.

If your camera has no ground-glass, set the photograph the distance indicated on the scale accompanying the copying, and sight along the top of the lens with the eye. Then set the focusing scale on the camera accordingly.

If the subject is a thin person and you wish to make him appear short and fat, simply lay the photograph in an inclined position as indicated in Fig. 2. The more incline, the more the ends of the figure will be brought together in perspective and the illusion of fleshiness gained.

Then again the operator may wish to accentuate the thinness or flesh-

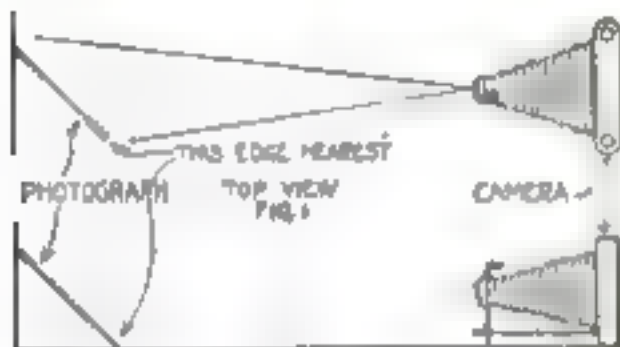


FIG. 2

To make your subject look thinner than he is, adopt the position shown in Fig. 1, to make him look short and fat, follow Fig. 2.

ness of the subject of the photograph even more than it is.

A still further distortion can be made by inclining the photograph and at the same time lifting one edge nearer the camera than the other.

By taking a little care you will be able to present your friends with pictures of themselves that will be very amusing. THORNTON HALLETT.

An Old Hacksaw Blade Makes a Durable Scribe

A DURABLE scribe can be made out of an old hacksaw blade. Old and broken blades are always and everywhere available. By grinding the end off square and thinning this down to an edge instead of a surface, two scribing points are produced.

The hardness of the blades makes the scribe lasting and the right-angle "point" has more backing than a needle point, which adds to its durability. Of course, such a scribe is not used for circles and similar work, but where long lines are to be laid out on metal, or where one piece is marked from another laid on top of it, it will be found very useful. The blade is, of course, moved in line with its thin section. DONALD A. HAMPSON.

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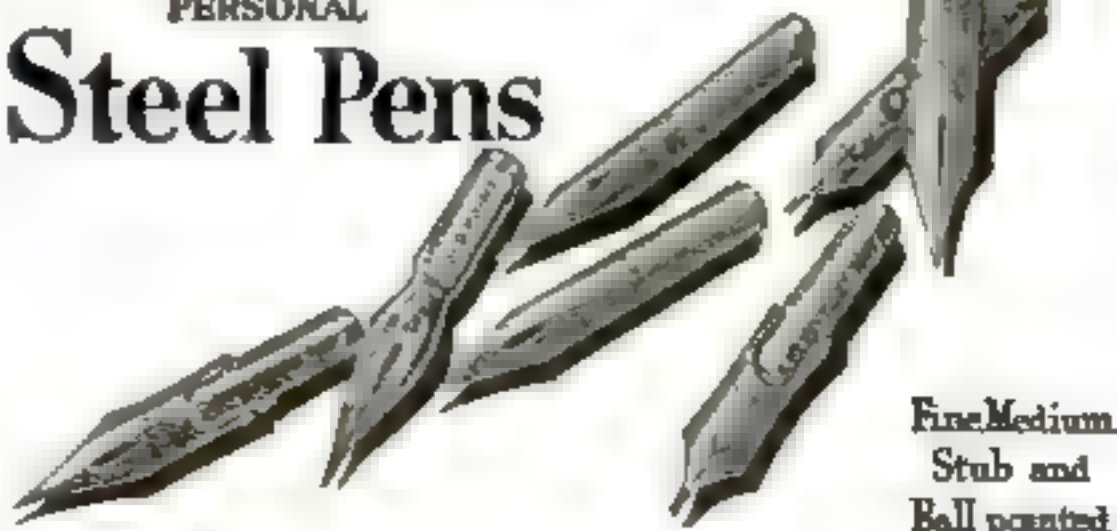
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three to five minutes, remove the plate and wash it thoroughly.

Lay the plate on a level slab, and place iron bars $\frac{1}{4}$ in. in thickness about one inch from the edges of the glass and parallel with them, as shown in Fig. 1. The bars should be well greased with lard or oil to prevent the plaster subsequently used from adhering to them.

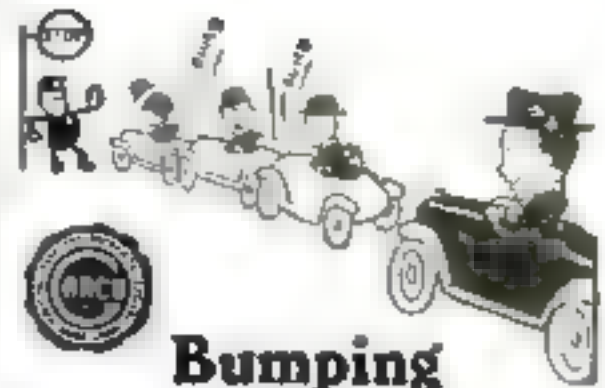
The Plaster Cast

Now prepare the plaster-of-paris (grade XXX) by pouring a little water into a basin and adding the plaster until it is the consistency of treacle. To this add a handful of powdered alum. It is best to pass the plaster through a fine sieve to remove any large or rough particles of foreign matter. The mixture should be well worked up with a wooden spoon, or stirred, and this should be done rapidly, or the plaster will set during the operation.

As soon as it is mixed, carefully pour the plaster upon the swelled gelatine print until the space between the bars is completely filled and is rather higher than the bars, care being taken to avoid air bubbles. It should be pressed down with a large shallow spoon or spatula. When the plaster begins to set, scrape the surface level with a straight-edge resting on the bars, and when set hard insert the edge of a knife beneath one end to push the glass and cast apart, removing the iron and trimming the edges. It is a matter of experience to determine how long to leave the plaster before lifting it from the gelatine print. By pressing the finger on the back the time can be judged. When it takes some pressure to make an impression the cast may be considered ready to lift. Thus is produced a negative in plaster, from which a copy is to be made in wax.

Copying in wax is done by removing the moisture from the face of the plaster negative with the aid of a cloth or sponge. The plaster negative is then laid flat and the iron bars again laid in the same position as when the plaster-of-paris was molded. Now pour upon this negative to the height of $\frac{1}{4}$ in. 8 oz. beeswax, 32 oz. paraffin, and 6 oz. rosin. When this has congealed or hardened separate it with a knife. Now give the wax print, or positive, a surface of fine graphite, and place it in a shallow basin, leaving in it a concentrated solution of copper sulphate. Sprinkle upon the surface of the wax image some fine iron filings. A fine copper film will immediately form on the surface of the graphite. Wash in running water and copper-plate in the usual manner.

It must not be supposed that this process is to become a competitor of the sculptor, but it is really intended to be a valuable aid to him. It may be commercially used for making signs, medals, cameos, brooches, and architectural pieces.—SAMUEL WEIN.



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Water-Glass for Preserving the Cistern

WATER-GLASS, which is used for preserving eggs, can also be used in cisterns. That is, it forms a coating upon the walls, keeping away pollution and the creeping in of surface or sub-surface water.

When a cistern is built, there is a pronounced chemical action between the water contained therein and the cement walls. As a result the water is very apt to become hard, possibly to such a degree as to be unpalatable. A copious application of water-glass will prevent this chemical action and soften the water.

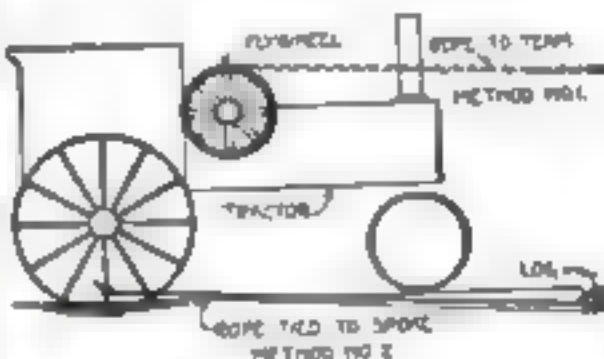
When building a new cistern, simply give it a final coat of cement, let it harden thoroughly, and then paint it with water-glass solution.

Water-glass is absolutely harmless, can be purchased almost anywhere, and will repay its use.—L. B. ROBBINS.

Even a Tractor Sometimes Gets Stuck in the Mud

COSTLY delays are often encountered in any farmer's tractor experience, because of miring down in wet or loose soil. This can sometimes be avoided by resorting to the use of proper methods.

One farmer hit upon a simple scheme which brought the tractor out in less than twenty minutes. In going from one field to another, the tractor was driven through a low spot



Has your tractor ever mired in deep mud or sand? Here are two good ways to get it out

which proved to be too loose for the drive wheels of the machine.

After several attempts to get it out by its own power, a rope was wrapped about the surface of the flywheel, after one end had been tied to one of the spokes. A team was hitched to the other end, the gear train thrown into mesh, and by wrapping the rope again as it was unwrapped from about the flywheel, as often as was necessary, the machine was slowly hauled out of the low spot. Lack of power in this case prevented the tractor from pulling through on its own power.

In another instance, a tractor that had mired down and lost its traction was able to pull out on its own power by sinking a timber in a trench several feet ahead of it, and fastening two log chains to it from the drive wheels.—DALE VAN HORN.

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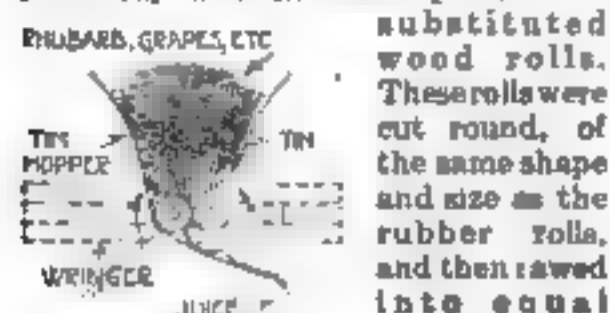
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A Rhubarb Press Made from a Clothes-Wringer

AN old clothes-wringer was converted into a press for extracting the juice of rhubarb by the following procedure. The rubber rolls were removed, and in their place were



substituted wood rolls. These rolls were cut round, of the same shape and size as the rubber rolls, and then sawed into equal halves. Notches were cut near each end to hold small

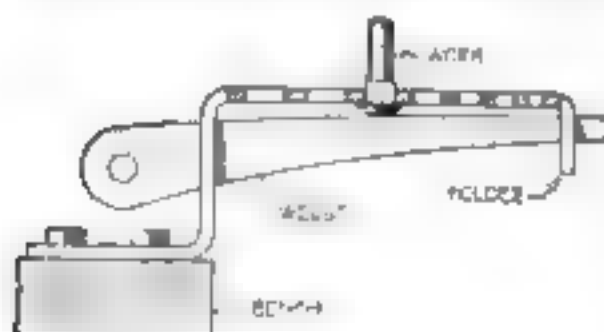
wire flush with the surface of the rolls. Then a core was cut in the center of each roll the size of the steel shaft.

The rolls were then placed on the shafts and held firmly in place with the wire. With a stiff spring tension the juice was easily extracted from rhubarb, grapes, and other fruit. A tin strip, bent to shape, was tacked on to the bottom of the wringer posts, one on each side, to drain off the liquid into some receptacle.—DALE VAN HORN.

Making a Suitable Holder for Pieces of Work

FOR the purpose of securing the piece operated on in a machine-shop, it is often necessary to construct a special holder, the shape and size of which must be governed by the particular conditions. For example, suppose that a bolt, rivet, or similarly shaped piece is to be clamped for an operation such as threading, filing, shortening, etc. Under such conditions, a device like the one illustrated may be used to advantage.

The holder shown consists of a bent metal strip with holes of various sizes for the bolts, and a wedge for securing



The wedge secures the bolt, rivet, or similar piece to be filed, threaded, or otherwise operated on

the bolts in position. The wedge passes through suitable slots in the metal strip, which is bent down into the horizontal portion for fastening to the bench.

The bolt or rivet is inserted in the hole that fits its shank, and the wedge is forced into place by a couple of light blows from a hammer. When the work is completed, the piece may be removed readily by lightly tapping the end of the wedge.—H. C. RIDGELY.

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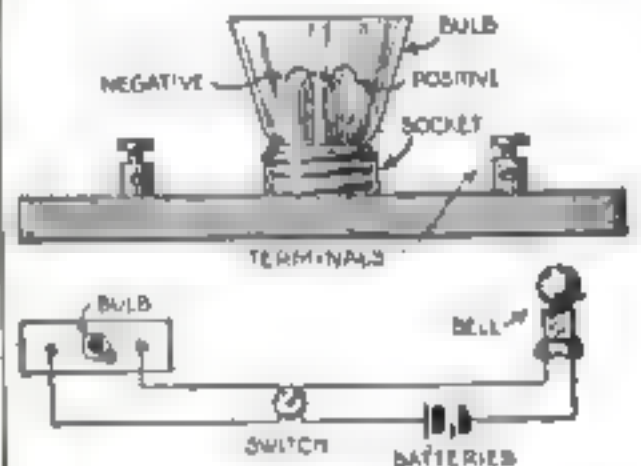
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There's the Rain-Alarm— Close the Window

IT is no joke to wake up in the middle of the night and find the windows open and rain coming in.

After one or two such experiences, one practical fellow made an automatic rain-alarm which was placed outside his bedroom window on hot nights when the windows were left open.

He secured an old electric-light bulb, and cut it in half by tying a string to it and wetting with alcohol, after first breaking off the tip. Then the lower half, including the base and terminals, was screwed into a socket, which was fastened to a board as shown. The large copper wires leading to the filament were bent back



Why wait to wake up and find that a midnight rain has ruined the window curtains? Make an electric alarm that will warn you when the rain begins to fall

down into the bottom of the cup, one on either side, care being taken to keep them from touching, and a handful of salt placed around them.

This was connected to a battery of two dry-cells, and then to a door-bell placed in the bedroom. A switch was also placed in the circuit, completing the outfit.

The action is obvious. As soon as any moisture reaches the salt, a solution is formed which is a good conductor of electricity, and immediately a current is set up which rings the bell. To break the circuit, turn the switch.—DALE VAN HORN.

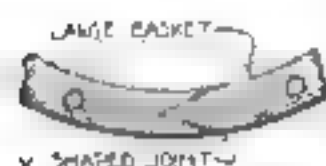
The Hairpin Becomes a Pair of Calipers

A PAIR of calipers is perhaps the most frequently used tool in the machine-shop, being required for almost every kind of job.

One day the writer wished to take some outside measurements and he couldn't find his calipers in the toolbox. His eye lighted on a scrub-woman in the next room and a bright idea came into his head. Why not beg a hairpin and make a pair of calipers with it? He followed up his idea, the measurements were taken, and when the job was finished it was found to align properly.—A. G. VIDAL.

Piercing Holes in a Large Gasket

WHEN overhauling an automobile—or, for that matter, any machine that has gaskets—it not infrequently happens that a gasket has to be made that is large and of awkward shape and therefore difficult to cut in one piece. Further, a large piece of material would be required to make a one piece job. If such a gasket does not have to withstand any great pressure, as would be the case in gasketing



Read this article and then you will know what to do the next time your engine gasket leaks

a front-end gear cover on the engine, or in some cases a gear-box cover, it can be made just as well from a number of separate pieces, making long V-joints where the pieces come together.

If you will look at the illustration above you will get the idea without any trouble.

Such a job will be entirely satisfactory if the gasket material is rather thick and compressible: cork composition, asbestos composition, and the like work very well. But for gaskets of thin paper or fiber, or for anything very hard, it will not do. Make the joints sufficiently long and fit them carefully, so that there will be contact along all the adjoining edges.

As each piece is finished, stick it in place with shellac; this greatly facilitates the fitting of the next piece. Keep the outer surface of the gasket clean, and when it is all in place rub it with a mixture of graphite and a little grease or oil. This will give you a gasket that will stay in place when next the cover is removed, will not stick to the cover, and will last indefinitely if made as described.—HOWARD GREENE.

How to Use Your Watch as a Protractor

IT was quite by accident that the writer discovered that a watch made an ideal protractor in an emergency

A circle consists of three hundred and sixty degrees, therefore each of the twelve hour spaces would consist of one twelfth of three hundred and sixty, or thirty degrees. Each hour is spaced off into five equal parts, so each space is exactly six minutes.

With a little care one can readily work to a degree with very good accuracy.—J. W. MOORE.



Here is a very old idea, but it is valuable to know in an emergency

Why Do Chiropractors Advertise and Is Advertising Ethical?

This question is often asked by those who sincerely wish the science of Chiropractic well, but who believe that by advertising the science is reduced to the level of patent medicine and quackery. Upon close questioning, however, it develops that it is not advertising, but rather some particular kind of advertising to which they object.

Webster defines advertising as "giving notice to the public," and ethics as "pertaining to the conduct and involving the moral question," i. e., the question of right and wrong, so that the question might be stated as follows: Is it right to give notice to the public that a great new discovery has been made in the method of getting the sick well? When the question is so stated it answers itself. It is as though one were to ask: Is it ethical to advertise where food is to be gotten to those who are starving or is it right to give notice of the discovery of a spring to those who are dying of thirst in the desert?

If Chiropractic is what chiropractors and patients claim it to be, it would be a crime to conceal it from a sick world. If it is half what they say it is, every moral impulse and every ethical consideration would urge those who know its merits to proclaim them.

Of course, if Chiropractic is a fraud, if it lacks merit or if it occupies a relatively small niche in the health edifice, such claims as are publicly made would merit the most severe condemnation and penalties. The wonderful increase in the number of practitioners and the rate at which the schools are multiplying, as well as the evident prosperity of the profession and the enthusiasm of the patients preclude any such conclusion.

Grant the ethical basis, then, of its being a thoroughly meritorious proposition, and the whole question simply resolves itself into a problem of how best to advertise its merits to that portion of the public who have never even heard its name or whose conception of its philosophy, science and art is incorrect.

So we may conclude that the question of advertising is simply a question of expediency and the question of ethics is involved in the merit of the science and the form in which the notice is given, rather than in the principle of the act of advertising.

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For the Radio Experimenter

Electron Relays as Amplifiers and Oscillators: II

By H. J. Van der Bijl, M.A., Ph. D.

IT was shown in the article in the POPULAR SCIENCE MONTHLY for April how the grid in a thermionic vacuum tube makes it possible to use this device to amplify currents. The fact that the insertion of the grid in the tube makes it possible for the tube to amplify also brings within its scope a number of other uses to which the tube can be put. In particular, it can be made to produce sustained oscillations. A device that can amplify can also produce oscillations.

The production of oscillations by an amplifier is sometimes troublesome. We shall show how the amplifying property of the tube enables it to produce sustained oscillations.

Amplifying the Currents

Referring to Fig. 1, which represents a simple amplifying circuit using the tube as an amplifier, it was shown in the first article that small currents entering the system at *A* are amplified by the tube, so that the current obtained in *B* is larger, and sometimes much larger, than that entering *A*. The circuit shown here, as well as some of the circuits we will show to explain how the tube produces oscillations, are drawn in as simple a way as possible to illustrate the functions that they perform. The batteries commonly employed in the circuit arrangements are omitted. Later on we shall give complete circuits showing the batteries and where they should be placed in order to get the best arrangement when using the tube as an oscillator. In Fig. 1 *T_i* is the input transformer and *T_e* is the output transformer. The transformers are inserted simply to have convenient impedances connected to the tube. Let us, therefore, consider only the coils of these transformers that are connected directly to the tube itself, that is, coil *L_i*, which is the secondary of the input transformer, and coil *L_e*, which is the primary of the output transformer. The energy in *L_e* is larger than that in *L_i* because of the amplification produced by the tube.

Now we can make the energy in *L_e* still larger if we take part of this energy and transfer it to *L_i*. This part will then be further amplified. An arrangement whereby this can be done is shown in Fig. 2. Here *L_e* is divided, one part of it being placed

close enough to the input coil *L_i* to act inductively on this coil. In other words, there is a mutual inductance indicated by *M* between these two coils.

Now the current in the input coil is amplified, and the amplified current obtained in the output coil flows through *L_e*, so that the input coil receives energy both from *A* and from *L_e* and *L_i*. This part of the energy, which is fed back from the output to the input, is further amplified so that more energy appears in the output coil, and therefore more is fed back. In this way it can be seen that the current in the output of the tube will keep on increasing until it is limited in some way or other. This limitation of the current is caused by the shape of the current voltage characteristic of the tube, something that we will presently explain.

The circuit shown in Fig. 2 is so arranged that the input current coming from the line *A* is amplified, and its period, or the frequency of the amplified current obtained in the output line *B*, is the same as that of *A*; but this principle of feeding part of the output back to the input can be used to make the tube produce sustained oscillations without the necessity of impressing any oscillations on the system from the outside. The circuit whereby this can be done is shown in Fig. 3. It will be recognized that Fig. 3 is the same as Fig. 2, except that the connecting lines *A* and *B* are omitted and that Fig. 3 contains a condenser, *C*. The coil also indicated by *L_i* corresponds to *L_i* of Fig. 2, and the output coil is here designated by *L_e*. *L_i* and *L_e* are so connected that there is a mutual inductance between them. By adding the condenser *C* we produce an oscillation circuit, *LC*.

It is well known that if energy is continually supplied to such a circuit it will oscillate with a frequency depending upon the values of the capacity *C* and inductance *L*, just as a pendulum will swing with a definite period. Suppose a slight change takes

place in the electron current flowing from filament to plate. This pulse will set the circuit *LC* oscillating with a frequency determined by the values of *L* and *C*. The oscillations will, of course, die out unless energy is continually supplied to the circuit.

This constant supply of energy is made possible by the amplifying properties of the tube. Thus a change in the current flowing in *L_i* causes a change of current in *L_e*. This produces a change in the potential of the grid, resulting in a further change in the plate current. If the phase relations in the plate and grid circuit are such that this effect is cumulative, the current in circuit *LC* will continue to oscillate with a frequency determined closely by the values of *L* and *C*, and will continue to increase in intensity until limited by the characteristic constants of the tube and the constants of the external circuit in such a way that the power dissipated is equal to the power supplied.

In order to be able to use a vacuum tube to produce oscillations, it is necessary to know how the production of the oscillations depends on the characteristics of the tube. This makes it necessary to introduce the important quantities, namely, the two plate resistances and the mutual conductance to the tube.

Plate Resistance

The plate-current, plate-voltage characteristic is shown in Fig. 4. Suppose that the normal voltage on the plate is given by the value *V*, so that changes in the plate current produced by changes in the plate potential will be represented by values lying above and below *A*. The ordinary d. c. resistance of the tube, like that of a wire, is given by the voltage divided by the current. That is, it is given by the reciprocal of the slope of the dotted line *OA*.

But the a. c. resistance of the tube is a different thing. Suppose that the plate voltage *V* be increased by a small amount such as *AB*. The current then increases to the point *C*. If the plate voltage alternately increases and decreases by the



FIG. 1
Vacuum tube circuit showing connections as an amplifier. Note the step-up transformer for input and the step-down for output.



FIG. 2
Feed-back circuit for vacuum tube, showing inductive coupling between the output and input circuits.

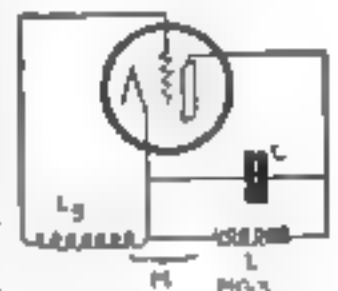
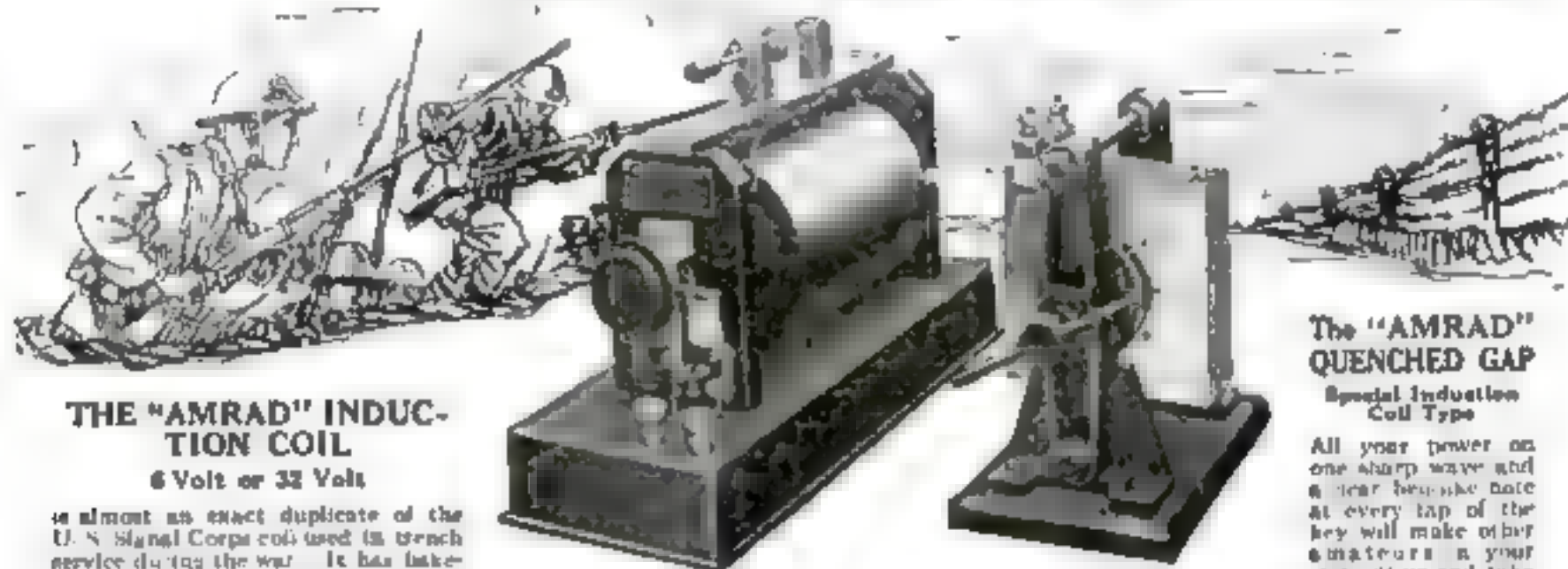


FIG. 3
Oscillator connection for vacuum tube: note coupling between output and input circuits and tuning condenser.

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amount AB , the plate current will oscillate over the amount given by CB . Now, the resistance of the tube to these oscillations is the increment in voltage AB divided by the increment in current BC , which is equal to the reciprocal of the slope AC indicated by the broken line DAC . This is the a. c. resistance of the tube when the current oscillates over the small portion AC of the characteristic. It will be seen that the slope of this line is different from the one that gives the d. c. resistance of the tube.

When the oscillations are not so small, but cause the current to vary over a much greater range than that indicated by AC , we can no longer talk of the slope of the curve, but we can to a first approximation represent the a. c. resistance of the tube by a line connecting the two extreme points of the characteristic over which the current oscillates. Thus, if the current increases to E and decreases to F , we can say that the a. c. resistance of the tube to such oscillations is given by the reciprocal of the slope of the line connecting E and F .

Mutual Conductance

The characteristic shown in Fig. 4 is the plate-current, plate-voltage characteristic, and from it we get an idea of the resistance of the tube. The mutual conductance, on the other hand, may be obtained by a consideration of the plate-current, grid-voltage characteristic, such as that shown in Fig. 5. Suppose the normal grid potential is such that the direct current flowing through the tube is given on this characteristic by EO . If the potential of the grid alternately increases and decreases so that the current oscillates around O between the values D and C , then the mutual conductance can be taken to be the slope of the dotted line DC . If the potential of the grid varies over such a wide range that the current increases to B (Fig. 5) and decreases to A , then the mutual conductance may be taken to be the slope of the line AB .

It will be noticed that the mutual conductance is given by the slope of the plate-current, grid-voltage characteristic, while the plate resistance of the tube is given by the reciprocal of the slope of the plate-current, plate-voltage characteristic. This quantity, mutual conductance, is given by the amplification constant divided by the resistance of the tube. Both these quantities and the mutual conductance may readily be obtained by simple measurements.

The mutual conductance is a very important quantity that is often

encountered in vacuum-tube work. It determines the quality of the tube as amplifier, detector, etc. At present we shall consider how it determines whether or not the tube can produce sustained oscillations. The oscillation circuit shown in Fig. 3 represents one of a number of different types, and is the one that lends itself most readily to mathematical solution.

The solution of this problem shows that whether or not the tube will produce sustained oscillations depends on whether or not the mutual conductance is greater or less than a quantity involving the constants of the oscillation circuit LC . This quantity may, for the sake of convenience, be represented by a line having a certain definite slope. Such a line is shown by GF to the left of Fig. 5, and we may state that the slope of this line depends, among other things, on how close the

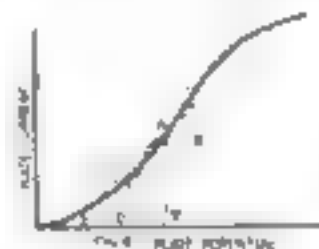
coupling is between the two coils L_1 and L_2 shown in Fig. 3; that is, it depends on the mutual conductance M between them.

Now, as long as the mutual conductance of the tube is greater than this quantity,—that is, as long as the slope of the line giving the mutual conductance is greater than the slope of the line GF ,—the tube will produce oscillations, and the strength of the oscillations will increase until the two slopes become equal. It will readily be seen by referring to Fig. 5 that if the variation in the plate current becomes greater, the mutual conductance becomes less; thus, while the current varies between the values D and C , the mutual conductance is given by the slope of the dotted line DC ; but when the current varies between A and B the mutual conductance is given by the slope of the dotted line AB , which is less than the slope of DC .

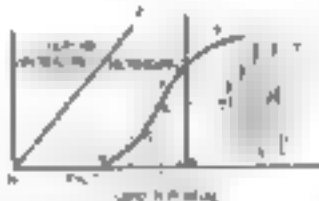
The oscillations produced by the tube will, therefore, increase in intensity, as shown to the right of Fig. 5, until the slope of the mutual conductance line becomes equal to the slope of the line GF .

Under the conditions for which this diagram is drawn, which shows that GF is parallel to AB , the strength of the oscillations will increase until the current rises to the maximum value B and drops to the minimum value A . If the coupling between the output and input coils were decreased, the slope of the line GF would increase, and the current would then not oscillate between values A and B , but over a smaller range. On the other hand, by increasing the coupling we can increase the intensity of the oscillations.

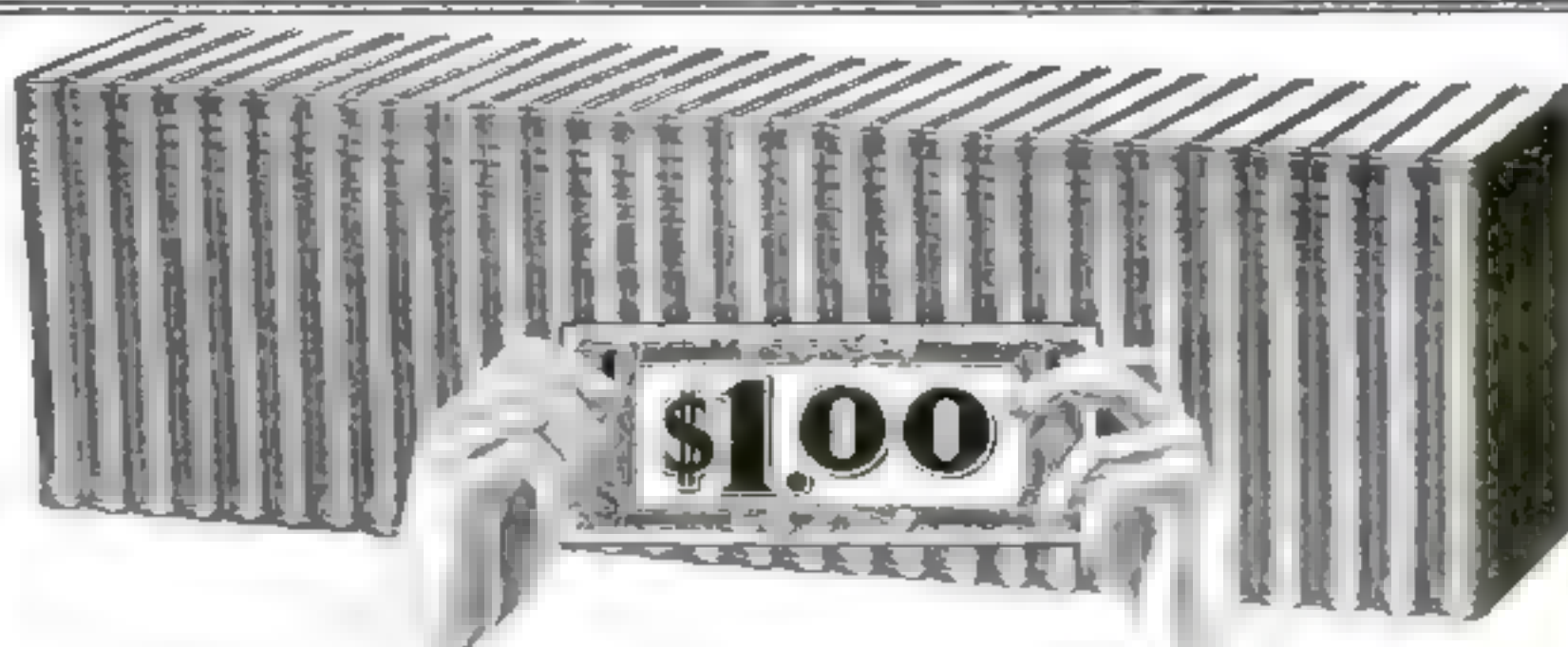
[The third and last article in this series by Dr. Van der Buij will appear in the POPULAR SCIENCE MONTHLY for June.]



Showing relation between plate-current voltage and plate current. Note variation in tube resistance.



Variation of plate current and grid voltage in an oscillating vacuum tube as the coupling is changed.



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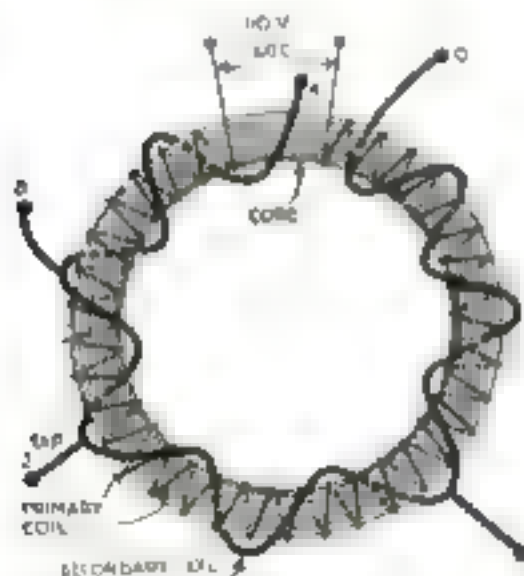
give; for the heating effect of the current decreases as we increase the size of wire. We must be careful to choose large enough wire to carry the current without excessive heating, which would spoil the insulation.

How one amateur solved the problem is told by Neil D. Cameron as follows.

The core was made of 18 in. length of hay bale wire. These were bent around a cylinder of about 4 1/2 in. diameter to form them. They were then bound tightly by strong wire into a ring, for I wished to make a Gramme ring type of transformer. Although each wire was thus closed into a ring, the ends were not allowed to touch, and the small air-gaps of the different wires were staggered to come at different points in the core.

This ring was put in a slow charcoal fire, that made it dull red, and left until the fire had died and the iron cooled. It was then tapped to knock off ashes. The binding wires were loosened, and shellac was poured through the core until each wire was thoroughly insulated. After drying, the bindings were tightened and the windings put on. During winding the binding wires were taken off one at a time. All must be removed, for they would otherwise act as short-circuited turns of a secondary winding.

The core was insulated by three layers of cotton tape. I used twill tape or scraps of cotton torn into strips about one inch wide. The primary was formed by about 800 turns of No. 24 D.C.C. magnet wire. Between successive layers of the primary



Winding diagram for a homemade transformer. The core is formed by wire. Steps 110 volts down to lower voltages

there was one winding of cotton tape. After the primary winding had been applied a double thickness of cotton tape was put on, and then the secondary. Seven and a half turns of secondary corresponded to a volt. I used No. 14 D.C.C. magnet wire and brought out taps for such voltages as I expected to require.

The tap wires were green insulated lamp-cord. When making a tap I was particularly careful to make a clean soldered joint, to leave no drops of solder, and to insulate the joint well with a small piece of friction tape. The scheme of winding is shown in the figure. I then mounted the transformer between two oak boards, bolting them together at the corners, but protecting the transformer from the bolts by slipping a piece of fiber fuse tubing over each bolt. The taps were brought out from one side and the primary lead-in wires from the other, both being terminated on clips mounted on one of the oak faces.



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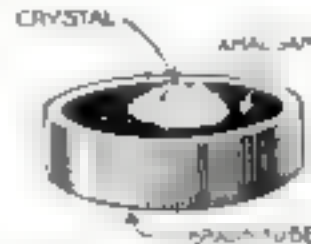
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Mounting Detector Crystals in Amalgam

A SIMPLE device for holding crystals for a detector may be made by the use of an amalgam, as shown in the sketch. The container may be a section of a small brass tube. However, almost any metal receptacle may be utilized.



An amalgam gives a good, firm contact, which is yielding nevertheless to such an extent that the crystal can be turned completely around if desired. Tin and lead amalgams, prepared by mixing their filings with a few drops of mercury, are always soft and very suitable for this purpose. — E. STETSON.

This homemade holder for the detector crystal permits its rotation.

It Produces 30,000-Voltage Direct Current

A MACHINE of several kilowatts capacity, that will develop 10,000 volts direct current, has long been sought. The machine here illustrated does this, and more, for it is possible to build it for voltages as high as 26,000 or 30,000 and capacities of 50 kilowatts.

In the past high-voltage d.c. has been obtained only with considerable difficulty, except in quite small capacities. For large capacities d.c. generators have been put in series; but, with a practical limit of something like 1,500 volts per commutator, any very high potential is obtained only with considerable complication.

For small capacities rectification of high-voltage a.c., by means of thermionic valves or by mercury-arc rectifiers, has been a common method. To some extent, particularly for X-ray work, synchronous commutators have been used. Even such cumbersome schemes as an oscillating switch, which carried a set of condensers from a parallel connection in which they were charged to a series connection in which they were used to charge the

service condensers, has been used for experimental purposes.

This new high-potential d.c. machine is a development of the synchronous commutator,



A transformer for changing from three- to nine-phase current.

and consists essentially of a commutator driven in synchronism with a polyphase a.c. which it rectifies. The number of phases of the a.c. supply depends upon the d.c. voltage desired.

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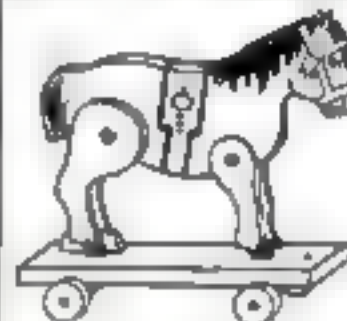
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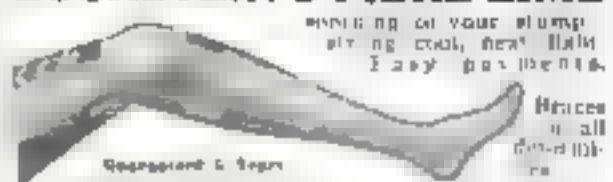


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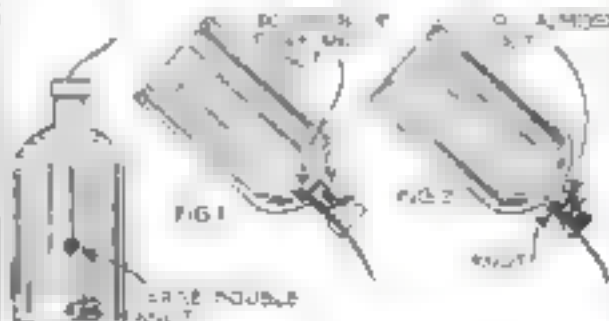
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Removing a Cork from the Inside of a Bottle

WHILE the glass bottle is not so popular as it was a year ago, it still has some uses. It often happens that a cork, that you are trying to



The next time a cork gets inside of a bottle, try this method of removing it

remove from its neck, is accidentally pushed down into its interior.

An easy way to remove this cork is to take a double piece of twine, tie a large double knot on one end, and lower it into the bottle. The next operation is that of tilting the bottle, so that the cork falls in line with its neck and upon the string. The string is then pulled until the knot engages between the cork and the neck of the bottle (Fig. 1). Another pull and it's out (Fig. 2) M. TOCABEN

Carry a Button-Hook When You Go Motoring

Did you know that a button-hook is a very useful thing to keep in your automobile?

With it you can locate and pull out small parts that fall into the mud-pan or inside the engine; and for the pulling out of cotter-pins it is the very best tool that could be used, for the hook seems to be made for the express purpose of catching hold of the looped end of the cotter-pin.

How to Turn a Ball on the End of a Rod

A QUICK way to turn a ball on the end of a rod—as, for instance, in making ball handles for machine tools—is to take a pipe the inside diameter of which is somewhat less than that of the desired ball, and grind it, leaving a keen edge. Cyanide hardening completes the tool.

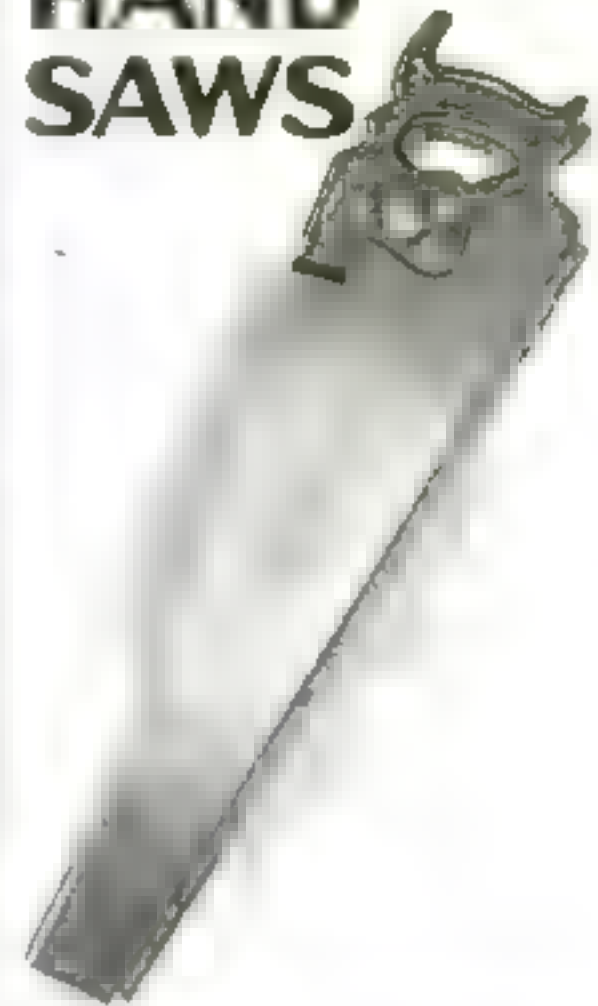
Turning a ball on the end of a rod is not easy unless you know how

the pipe as a hand tool, giving it a twisting motion that can be made to cut a smooth shaving from the ball.

Before using the tool, the ball should be brought approximately to shape.

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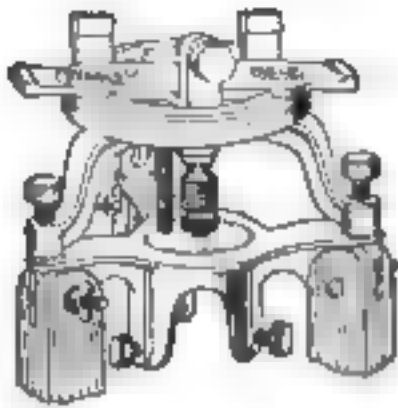
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As now made it can readily be attached to a tripod.

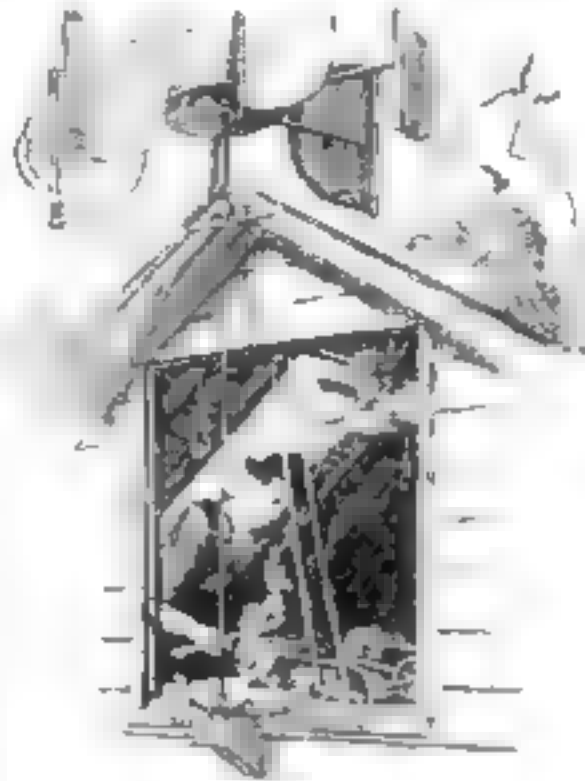
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Harnessing the Summer Zephyr

How to make a windmill that will operate light machinery

By Thorton Hallett

FREQUENTLY a small amount of power is wanted to operate very light machinery, toys, fans, etc., and no power is at hand except the wind. This, however, can be harnessed to do the work if the amateur mechanic will only gather together a few tools and



You can rig up an arrangement and put the wind to work. You will be surprised at the amount of labor it will do.

utilize the cast-off things about his bench. The little windmill shown here is not intended for speedy work, but will give a fairly steady power when the wind is anywhere near fixed velocity.

The base of the windmill is a wooden disk about two feet in diameter. Mount six spokes around its center, equal distances apart as shown, and bolt them to the top of the disk with three carriage bolts apiece. Each spoke is $3\frac{1}{2}$ ft. long, measuring from the center of the disk. This makes the spread from opposite spoke ends approximately 7 ft.

Bolt an upright to each spoke and 18 in. long, as illustrated, and secure with a wire stay fastened to each end and passing through a hole in the spoke.

Next, make six sails. This is done by constructing a light wooden frame and covering with tightly stretched canvas. They can be made in the shape shown or oblong, as desired. Oil the canvas with boiled linseed oil to protect it from the weather. Secure the sails to the uprights on the ends of the spokes with stout hinges, top and bottom, so the sails will all swing in the same direction.

Bolt a pipe-flange to the center of the under side of the disk, and thread

a suitable length of small straight pipe into it for a shaft. Keep it from unthreading with a set-screw.

Have this shaft long enough to reach down to the top of the window and keep the sails a foot or two above the roof.

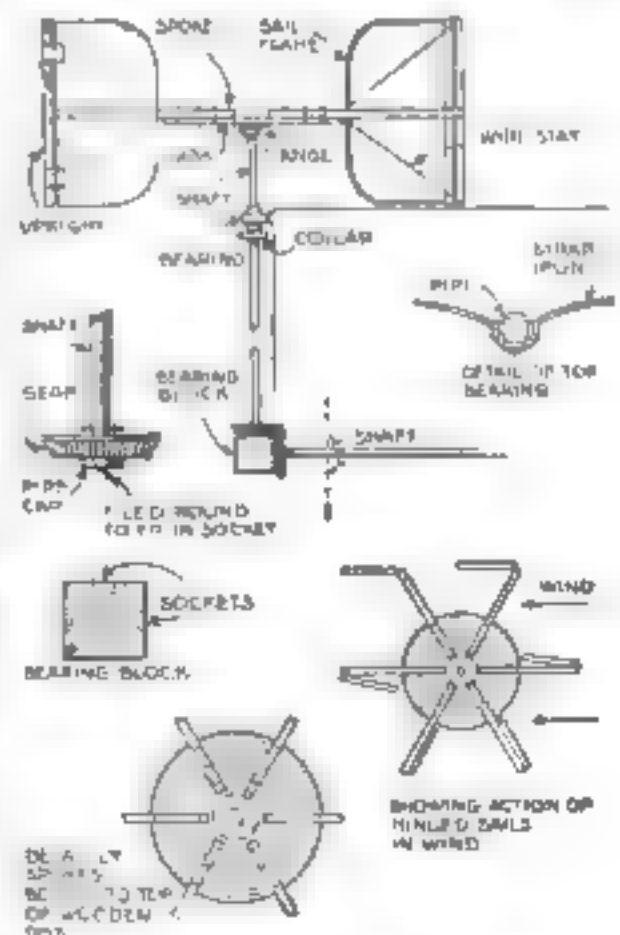
Drive a suitable bevel gear on the lower end, and mesh it with another at right angles attached to the drive-shaft in the room. Cap the pipe over each gear, and thread in a plug that has been filed round and smooth. These set and revolve in greased sockets in a heavy oak block fastened to the side of the house in the proper position to line the shafts up in a true vertical and horizontal position.

A second bearing should be fitted to the vertical shaft at the peak of the roof. Make this of a section of larger pipe held in position with strap-iron riveted to it and bolted to the building. A collar below it prevents the shaft from rising and pulling the gears out of mesh.

Set up all threads with set-screws and thoroughly oil any parts of the work exposed to the weather.

Use as light parts as possible throughout, to insure easy working, but do not sacrifice strength.

If properly made the windmill will surprise one with the many things it will do. With a little ingenuity the revolving shaft can be attached to numerous small things, such as the butter-churn, the cream-whipper, etc.



Made from cast-off things about the house, this small but efficient windmill can be made to do a variety of odd jobs.

For Small Garage Owners

You can make a shop crane for lifting engines

A SHOP crane in a small garage that was very inexpensive to build proved extremely useful in lifting automobile and truck engines in and out of the chassis. Its use on a few jobs paid its initial cost. The crane was constructed as follows:

A piece of timber, either spruce or hard pine, 8 in. long, 4 in. wide, and 8

in. deep, is needed for the cross or top piece. This is used to carry the block and tackle.

Next get two pieces 8 ft. by 4 in. for the uprights or side pieces. For the floor pieces take two pieces of heavy plank, each 8 ft. long, 4 in. thick, and 8 in. wide. Cut a mortise in one end of the uprights 2 by 4 in. long. Make a hole exactly in the center of each floor piece to match the mortises.

The top end of the uprights should be squared. With a square lay off on one end of the first upright a line 4 in. from the end. Turn the stick over sideways and continue the line around until it meets the line where it started. On this line, 1 in. in from the edge, make a cross mark. Turn the stick over half way, and mark again, making sure that the crosses are exactly opposite each other. Do the same on the end. Take a saw and cut out the block on these lines, and repeat the operation on the second upright. Square the ends of the 8 ft. by 8 in. by 4 in. thick stick. Then, with the square, lay off 3 in. from the end, and square this around the stick until it meets the line at the start. Next measure off 4 in. on this line and mark it. Do the same on the opposite side, being sure that the lines are directly opposite. Mark off the end in a like manner, and then take the saw and cut this block out. The block will be 4 by 4 by 3 in., leaving the ends of the stick 4 by 4 in. and the cut-away por-

tion 4 by 4 in. and the depth cut 3 in. Do the same with the other end of the stick. Have a blacksmith make the necessary strap and brace-irons. For the bottom of the uprights you will need four heavy braces of flat iron 3 in. wide and $\frac{1}{2}$ in. thick. These irons should be 2 ft. 9 in. long, with holes drilled in the ends for $\frac{1}{2}$ -in. bolts. On the same line with the cut at the top, 18 in. down from the top of one of the side pieces, draw a line with the square. Follow on down the side, and mark off 1 in. on this line. Turn the stick, and mark the opposite side in the same manner; 6 in. above this toward the top square off another line. With a saw cut out this triangular piece. Do the same with the cross-piece at the top. These are the seats for the corner braces of 4-by-4-in. stock, and later will be bolted together with $\frac{1}{2}$ -in. bolts. Work the other end in the same manner, marking off with the square 18 in. from the corner each way and cutting out for the brace seats.

When setting up the crane, start with the floor pieces. Next, set up an upright with the notches on the stick to the side. Be sure that the mortises at the bottom fit snugly. The upright can either be nailed or a hole bored and a bolt put through it crosswise of the plank. Set up the other upright in the same way, and put brace-irons on the bottom, bolting them into place as you go. Laying off the two sides about 9 ft. apart on the floor, with the brace slots and notches at the top facing, put the cross-piece into place. Raise the ends of the side pieces from the floor and rest them on a box. Set them into place, and the job is complete.

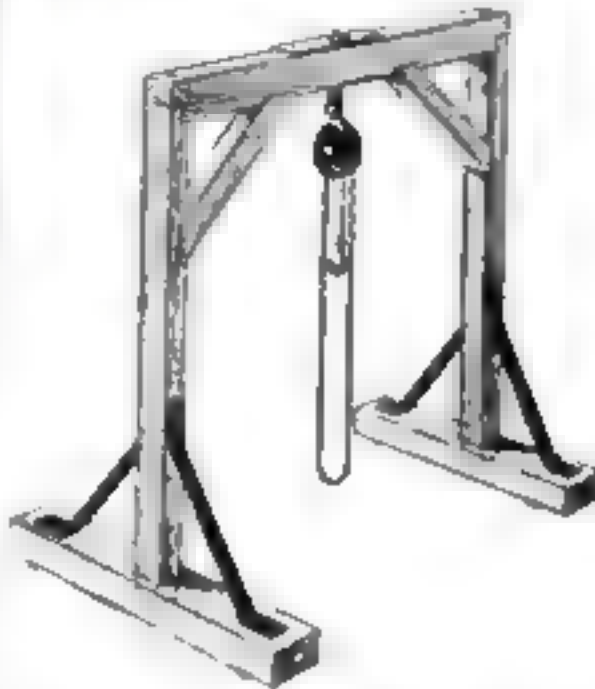
This Cover Keeps Free the Fire-Barrel Head

IN buildings where fire-barrels are used, it is generally the practice to make a round cover to place over the barrel to keep out the dirt. About

half the time these covers are mislaid, or materials are placed upon them because they afford a convenient resting-place.

In order to overcome difficulties of this nature, a conical-shaped cover can easily be made of tin.

This cover cannot be easily knocked off, and it does not present a flat surface to tempt the lazy man to lay something on.—J. R. MINTER.



In small garages the usual way to lift an engine or heavy part is by falls and tackle suspended from the roof. A home-made crane eliminates this tiresome work.

in. deep, is needed for the cross or top piece. This is used to carry the block and tackle.

Next get two pieces 8 ft. by 4 in. for the uprights or side pieces. For the floor pieces take two pieces of heavy plank, each 8 ft. long, 4 in. thick, and 8 in. wide. Cut a mortise in one end of the uprights 2 by 4 in. long. Make a hole exactly in the center of each floor piece to match the mortises.

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Why Forgings are Superior to Castings

WROUGHT metal is tougher, stronger and more reliable than cast metal. Consequently, for safety or dependable service, wrought metal is used, its great superiority in these qualities being universally recognized. A casting has no close, tough grain—it is naturally brittle. As "blow holes"—cavities due to gas—are often formed beneath its surface, it is impossible to know whether the casting is solid, or hollow, at its vital point. Its appearance of solidity may be, literally, a "hollow sham," concealing a dangerous defect. Castings are never used where maximum strength is combined with minimum weight.

Drop-Forgings are made from hammered, or rolled—wrought—bars. Even their raw metal, therefore, is much tougher than the finished casting; this metal is still further improved and refined by the compressive and strengthening blows it receives from the drop-hammer, the "ram" or hammer of which weighs up to 12,000 lbs.

The tenacious toughness and dependable strength of Williams' Superior Drop-Forgings and Drop-Forged Tools are the result of experience gained during nearly half a century of constant effort to make only the best.

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WILLIAMS' "AGRIPPA"
TOOL HOLDERS



for all regular machining operations.

Utilize Old Barrels by Making a Water-Tank

In these days of the high cost of everything old barrels can be put to an important use

By Windsor Crowell

AN inexpensive though serviceable water-tank for the farm, shop, or camp can be constructed of barrels, and will do all that the more costly kind will. The number of barrels necessary to use depends, of course, upon the volume of water it is desired to store and consume at each pump-

shown, until the ends of the threads are reached. Then thread each pipe into the ends of the respective barrels until the lock-nuts bear against them.

A piece of felt soaked in white lead will help make a joint water-tight if placed between the wood and the lock-nut. With these in place, connect the union, and the two barrels will be connected with each other. Place substantial blocking between their edges, so the piping will not be strained and so they will stand perpendicularly and rigid. Connect B to C in the same manner.

Drill the top hoop of barrel C, and place three or four large eye-bolts around the rim, to which may be fastened stays to keep the tower from swaying in high winds if placed outdoors.

The supply-pipe from the pump can be run vertically along the sides of the barrels as shown, and secured to their sides by means of little metal clips. Extend the discharge end of the supply-pipe down into the barrels several inches, to avoid loss of water in high winds.

The bottom of barrel A is bored and tapped as already explained, and the discharge-pipe carried from it by means of an elbow or T. A shut-off

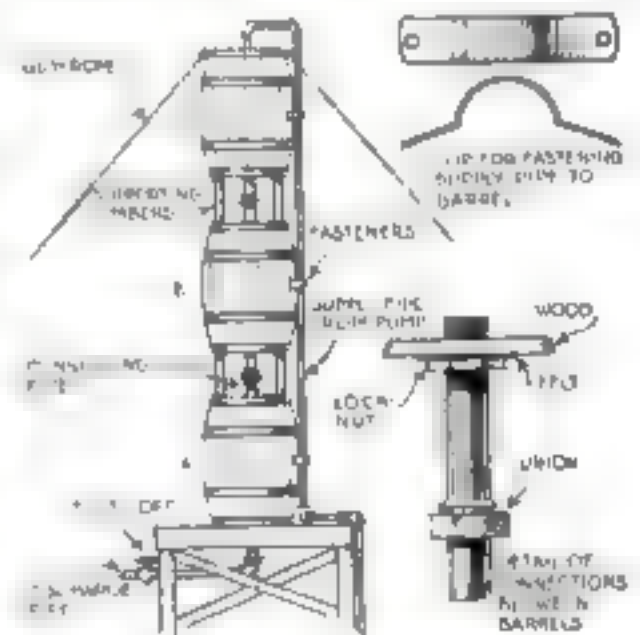


How the water-barrel tank will appear when finished. Surely this is a good substitute for a galvanized water-tank

ing; the illustration, which is of a tank made of three barrels, will supply the average family with a day's supply of water. If the water is to be used for drinking purposes, the barrels must be thoroughly cleaned before assembling, but if for washing, irrigating, or similar purposes such precautions are not necessary. The barrels will clean themselves in time.

First, erect a platform at the desired point sufficiently large to accommodate an up-ended barrel. This may be braced to a roof, on high land, or built up from the ground. Always keep in mind, however, that the maximum height of the water-level will determine the pressure, namely, about one half pound to each foot elevation.

Barrels A and B must have the heads left in, but barrel C can either have the head removed or a large hole cut in the middle to allow water to run in and any overflow to escape. Bore a 1 $\frac{3}{8}$ -in. hole in the middle of each end of each barrel. Be sure there are no tears or splits to allow water to escape; also remove burrs. Then connect A to B and B to C by 1 $\frac{1}{2}$ -in. galvanized pipes, as shown. These are made up of two sections of pipe joined by a union in the middle and the opposite ends of the pipes threaded. Separate the sections, and run on a lock-nut, as



Here is a diagrammatic view of the entire assembly. Note how the wires are arranged to prevent the tower from being blown over

near the tank will facilitate retaining the contents in the barrels in case the piping along the line is to be disconnected for any reason.

Paint the outside of the barrels and all exposed metal parts, and you will have a storage-tank to be proud of and one that will cost but little.

If properly taken care of the tank will last a long time. Be sure that all parts are painted to protect them from the weather.

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Will it give as good
results as
other tools?

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supplied tools to
satisfied machin-
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reason, the
is evident and
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**Brown & Sharpe
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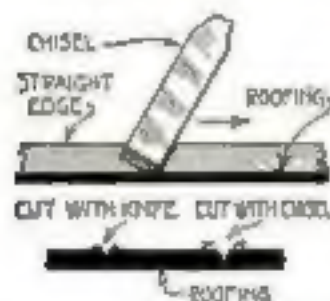


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How to Cut Roofing with a Chisel

VARIOUS kinds of knives are employed in cutting roofing; and, though some of them are better than others for the purpose, none of them are satisfactory.

The reason is inherent in the knife, and is that, no matter how it is shaped, it has a wedge action. This



Try a chisel instead of a knife the next time you cut asphalt roofing

works all right in some materials, but very badly in a tough, hard fiber saturated with asphalt, and often covered with grit, which takes the sharp edge off after the first cut.

Try a chisel the next time, and note the difference. It should be sharpened in the usual way, though the most important thing is not to keep the end cutting edge in shape, but to keep the side edges sharp and square with the broad surfaces of the chisel. A $\frac{1}{2}$ -in. or $\frac{3}{4}$ -in. chisel is best.

The tool should be held slightly inclined in the direction of cutting. Considerable force may be employed, and the rapidity with which the tough sheet is parted will be a revelation.

The reason, of course, is that the square, sharp side edges of the chisel plow out the material and remove it ahead of the tool, instead of wedging into it.

This is also the reason why the edges of the chisel last ten times as long as the knife-edge; for the sanded surface is also plowed out and thrown aside before it can do much harm to the cutting edges.—HENRY SIMON.

A Simple and Useful Electric Light Adjuster

A USEFUL, very simple and inexpensive shade adjuster can be



Does that swinging electric light annoy you? Then make an adjuster

made from two clamps and a piece of string. The clamps are tied to the end of the string. By fastening one of the clamps to the edge of the shade and the other to different points on the cord, the

illumination may be directed to any angle.

The same device may be used in adjusting the length of the cord, as shown in the illustration.

This idea though crude, will be found to solve many a lighting problem by throwing the light exactly where it is needed.

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JOHNSON'S CARBON REMOVER



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YOU can keep your motor snappy and full of "pep" by *preventing* the accumulation of carbon. Don't wait until your engine is choked and caked with it. Use Johnson's Carbon Remover every 500 miles, then the carbon is removed while it is soft and powdery, eliminating the frequent grinding of valves and *keeping* the motor *always* clean. No experience or labor required—you can easily do it yourself in ten minutes—and the cost is trifling.

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Johnson's Black-Lac—the perfect top dressing.

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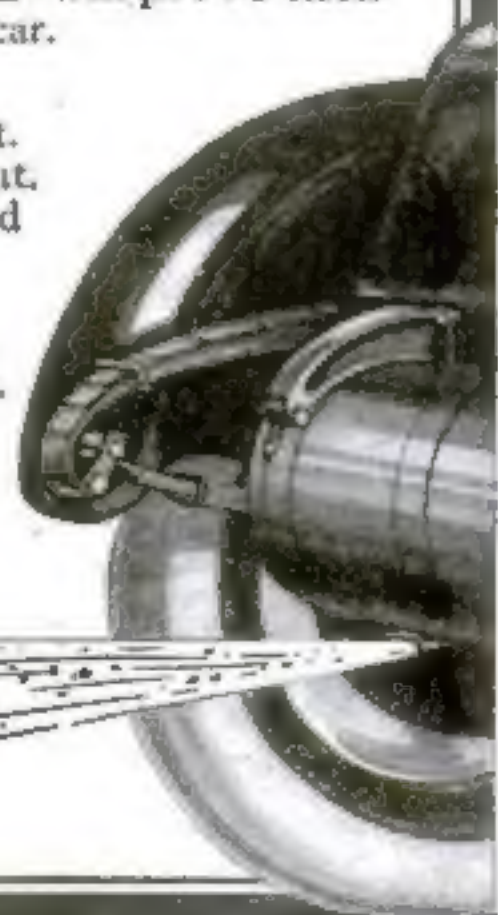
Johnson's Hastee Patch—can be applied in two minutes.

Write for our folder on "Keeping Cars Young"—it's free.

S. C. JOHNSON & SON

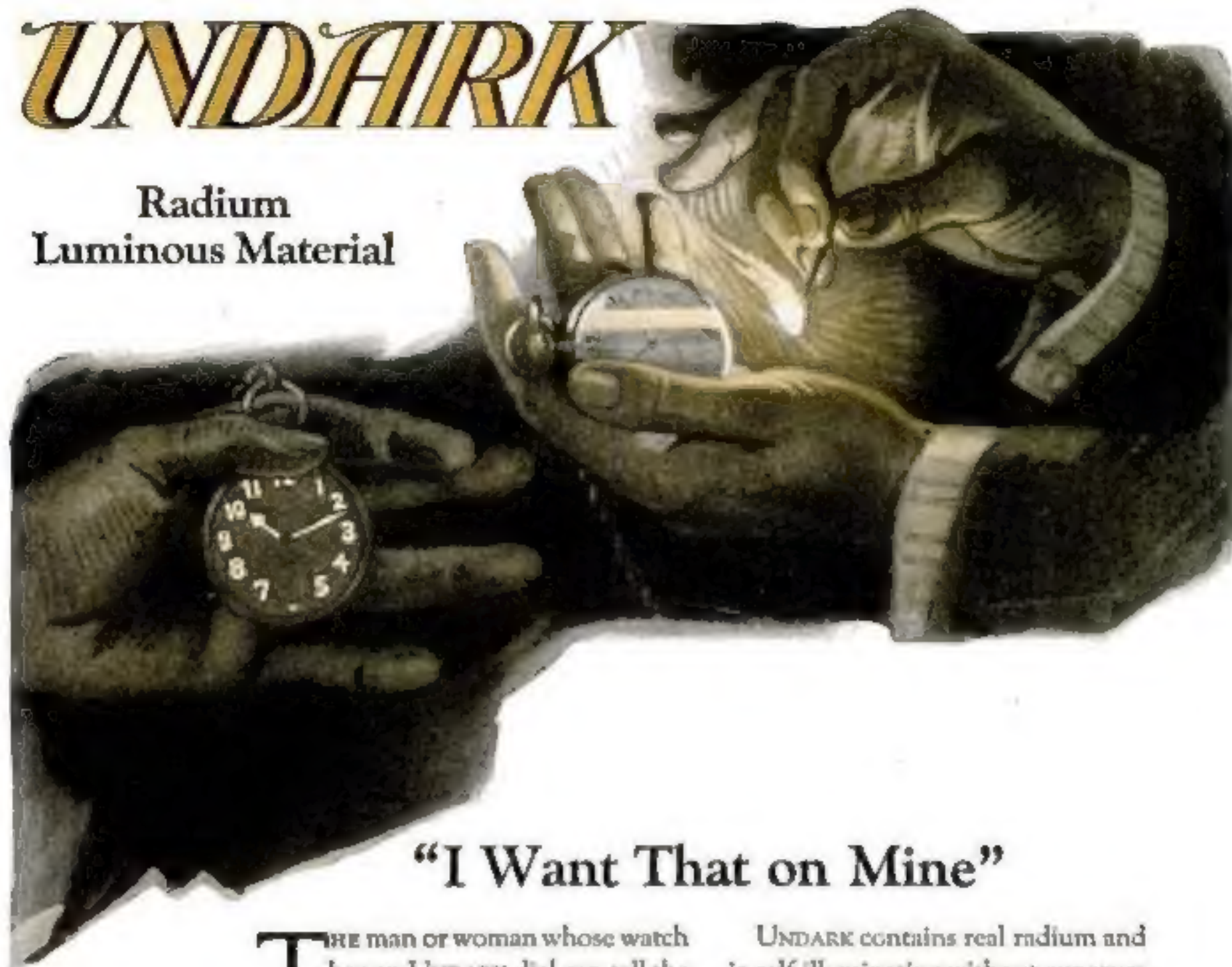
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Radium Luminous Material



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THE man or woman whose watch has an UNDARK dial can tell the time as readily at midnight as at midday. They don't have to light matches, or go without knowing the time even on the blackest night.

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The Radium Luminous Material Corporation is a large miner and refiner of radium-bearing ore and the pioneer manufacturer of Radium Luminous Material in this country.

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You will say, "I want that on mine!" the instant you realize its convenience.

Our service of instruction and inspection encourages the application of UNDARK by the manufacturer in his own plant.

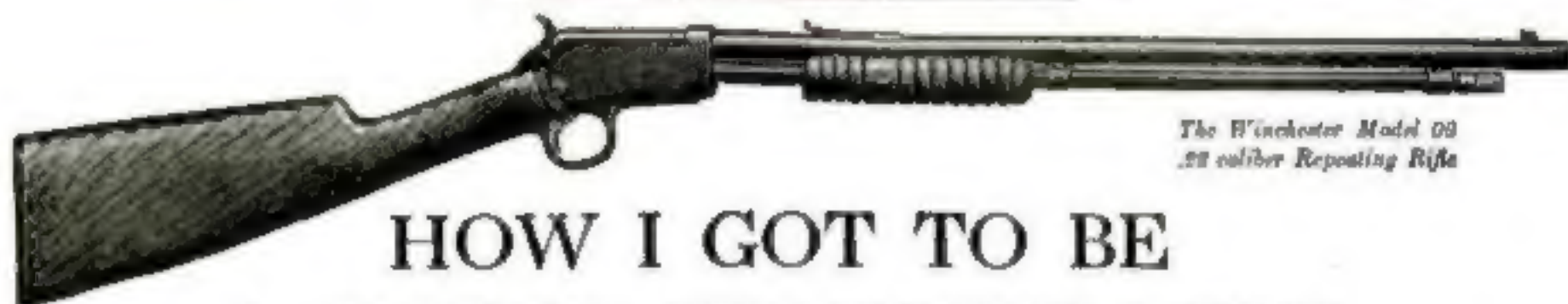
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The Winchester Model 99
.22 caliber Repeating Rifle

HOW I GOT TO BE A JUNIOR SHARPSHOOTER

IT WAS only three weeks after I joined the Winchester Junior Rifle Corps that I won my first medal and the rank of Marksman. Yet right away the other boys in our unit said I didn't dare make any more low scores.

I couldn't see how I was going to shoot that well, but our instructor, Mr. Bradley, turned me over to his new assistant, Mr. Kerr, for special instruction.

Mr. Kerr had been with the Marines in France! He helped me a lot, and I soon got so I could now and then make the necessary score of 24 out of a possible 25. It takes a total of fifteen such targets to win the W. J. R. C. Sharpshooter Medal.

Then Mr. Kerr said I wouldn't be a real Sharpshooter unless I could make the necessary scores without being coached. And of course he was right.

I kept plugging away, most of the time without his help, getting a 24 now and then, but no perfect scores. Once in a while, Mr. Kerr coached me. Finally, when I had two more qualifying targets to make, I managed to shoot two perfect scores of 25 without the help of my coach! I'll say I was happy!

I am prouder than ever of my Winchester repeater; for the more I shoot it the more I appreciate its fine accuracy.

Of course a boy does not have to own a repeater to get to be a W. J. R. C. Sharpshooter.

The rules allow you to use any Winchester, so long as it is .22 caliber. And several of the boys who have only the little single-shot kind are doing fine. Mr. Bradley says the steel in the barrels is all alike in quality and they are all bored the same way. Also, that the ordinary Winchester cartridges we buy are the same as many expert grown-up shooters use in matches.

Now I am going to try to win a W. J. R. C. Expert Rifleman Medal. I guess that will take a long time. But while I am trying I will be helping our unit, for Mr. Bradley has chosen five of us to enter the W. J. R. C. State and National Matches.

T

You too, boys. Start now. Hike down to the hardware or sporting goods store in your community where they sell Winchester .22 caliber Rifles and Ammunition. Buy a rifle, if you need one, and some ammunition, get a complimentary instruction book and some targets, and arrange to attend target practice.

National Headquarters, Winchester Junior Rifle Corps
673 Winchester Ave., New Haven, Conn., U. S. A.
Gentlemen:

I would like to join the Winchester Junior Rifle Corps. Please send me certificate of membership, and other information. Also tell me how to organize a Local Unit of the W. J. R. C.

Name

Street Address

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